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THE
NEW GRESHAM
ENCYCLOPEDIA

VOLUME XI

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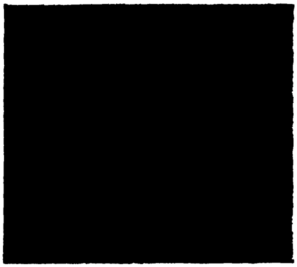

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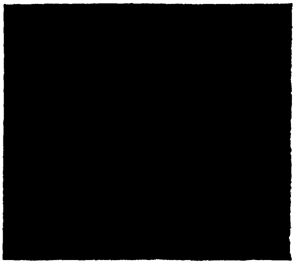

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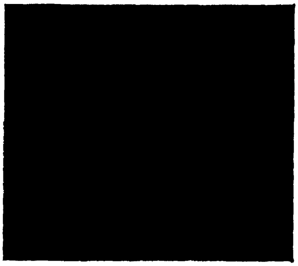

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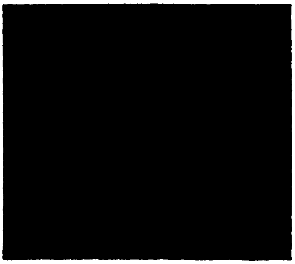

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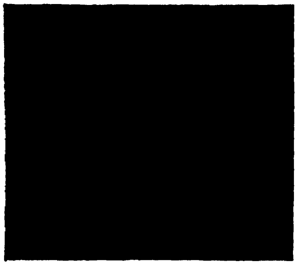

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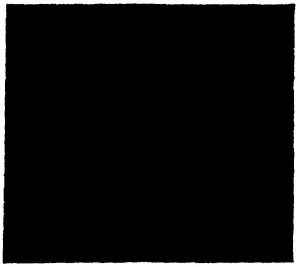

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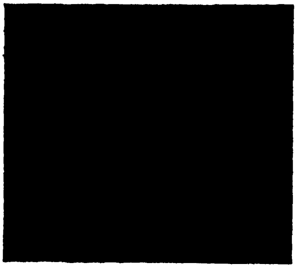

Tulip

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VOLUME XI

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KEY TO PRONUNCIATION

The method of marking pronunciations here employed is either (1) by marking the syllable on which the accent falls, or (2) by a simple system of transliteration, to which the following is the Key:—

VOWELS

ā, as in f*a*te, or in b*a*re.

ä, as in *a*lms, Fr. *â*me, Ger. B*a*hn=á of Indian names.

á, the same sound short or medium, as in Fr. b*a*l, Ger. M*a*nn.

a, as in f*a*t.

a̤, as in f*a*ll.

a, obscure, as in rur*a*l, similar to *u* in b*u*t, ė in h*e*r: common in Indian names.

ē, as in m*e*=*i* in mach*i*ne.

e, as in m*e*t.

ė, as in h*e*r.

ī, as in p*i*ne, or as *ei* in Ger. m*ei*n.

i, as in p*i*n, also used for the short sound corresponding to ē, as in French and Italian words.

eu, a long sound as in Fr. je*û*ne=Ger. long *ö*, as in S*ö*hne, G*ö*the (Goethe).

eu, corresponding sound short or medium, as in Fr. p*eu*=Ger. *ö* short.

ō, as in n*o*te, mo*a*n.

o, as in n*o*t, *so*ft—that is, short or medium.

ö, as in m*o*ve, tw*o*.

ū, as in t*u*be.

u, as in t*u*b: similar to ė and also to *a*.

ṳ, as in b*u*ll.

ü, as in Sc. ab*u*ne=Fr. *û* as in d*û*, Ger. *ü* long as in gr*ü*n, B*ü*hne.

ù, the corresponding short or medium sound, as in Fr. b*u*t, Ger. M*ü*ller.

oi, as in *oi*l.

ou, as in p*ou*nd; or as *au* in Ger. H*au*s.

CONSONANTS

Of the *consonants*, **b**, **d**, **f**, **h**, **j**, **k**, **l**, **m**, **n**, **ng**, **p**, **sh**, **t**, **v**, **z**, always have their common English sounds, when used to transliterate foreign words. The letter **c** is not used by itself in re-writing for pronunciation, **s** or **k** being used instead. The only consonantal symbols, therefore, that require explanation are the following:—

ch is always as in ri*ch*.

d, nearly as *th* in *th*is=Sp. *d* in Ma*d*ri*d*, &c.

g is always hard, as in *g*o.

h represents the guttural in Scotch lo*ch*, Ger. na*ch*, also other similar gutturals.

ṇ, Fr. nasal *n* as in bo*n*.

r represents both English *r*, and *r* in foreign words, which is generally much more strongly trilled.

s, always as in *s*o.

th, as *th* in *th*in.

th, as *th* in *th*is.

w always consonantal, as in *w*e.

x=ks, which are used instead.

y always consonantal, as in *y*ea (Fr. *ligne* would be re-written lēny).

zh, as *s* in plea*s*ure=Fr. *j*.

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Swanage, an urban district, watering-place, and seaport of Dorset, England, on Swanage Bay. Quarrying is the main industry; the shipping is negligible. Pop. 7100.

Swan River, a river of Western Australia, which colony was founded (1829) as the 'Swan River Settlement'. Perth, the capital of the colony, is on the Swan River, and Fremantle is at its mouth.

Swansdown, a name for a fine, soft, thick woollen cloth, or for a thick cotton cloth with a soft nap on one side, obtained in both cases by a process of raising. The weave for swansdown fabrics is generally the one up, three down, broken twill.

Swansea (W. *Abertawe*), a county and municipal borough of Glamorganshire, South Wales, on the Tawe at its entrance into Swansea Bay (Bristol Channel). Copper-working was once the chief industry in the borough, but the development of adjacent coal-fields and the fact that copper is now smelted as near the mines as possible have brought about a decline in the copper industry and a corresponding rise in those of iron and steel. Tin-plates, steel-tubes, &c., are made. Not only is Swansea a great distributing centre for coal transported by sea, and one of the foremost bunkering ports of Britain, it is also one of the world's foremost oil-delivery depots.[1] There are 282 acres of docks, with 32,000 linear feet of quays, 27 coal-hoists, 120 cranes, and 750,000 sq. feet of warehouses and sheds. Pop. (1921), 157,561.

Swatow′, a treaty port of China, in the province of Kwang-tung, at the mouth of the Han River. It was opened to foreign commerce in 1869. The principal exports (mainly to Hong-Kong) are sugar, paper, tobacco, and tea. Pop. 40,000.

Swaziland, a small native state in South Africa, under British control, on the south-east of the Transvaal; area, 6678 sq. miles. It is mountainous, and has great mineral wealth. Gold, coal, and alluvial tin (cassiterite) are found. Tobacco, maize, millet, ground-nuts and beans, &c., are raised. Mbabane is the administrative centre, and maintains tri-weekly motor communication with Bremersdorp and Carolina, the only transport in the country except small carts and runners. The Swazis are of the Zulu race, and have always been friendly to the British. Pop. (1921), 133,563.

Sweating Sickness, an infectious disease which manifested itself in severe epidemic outbreaks in England during the fifteenth and sixteenth centuries. More recent outbreaks on the continent of Europe have not been widespread or of long duration. The profuse perspiration which characterizes the disease lasts until convalescence. There is also an eruption resembling millet-seeds, which has given the name *miliary fever* to the disorder. A high mortality marked the outbreaks in mediæval England.

Sweating System, originally a slang expression applied to a system of sub-contracting work, especially in the clothing trade, to poorly paid workers in their own homes. About the year 1850 Charles Kingsley and the Christian Socialists, with the help of the *Morning Chronicle*, carried on a vigorous campaign against the 'sweating system', which Kingsley denounced in his tract *Cheap Clothes and Nasty; by Parson Lot*, and in *Alton Locke*. In the tract Kingsley described the system in the following terms: "Part of the work, if not the whole, is let out to contractors or middlemen—sweaters, as their victims significantly call them—who, in their turn, let it out again, sometimes to the workmen, sometimes to fresh middlemen; so that out of the price paid for labour on each article, not only the workmen, but the sweater, and perhaps the sweater's sweater, and a third, and a fourth, and a fifth, have to draw their profit". Kingsley and his friends attempted to combat this evil system by forming co-operative workshops, which, however, were not very successful.

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[1] At Llandarcy, near Swansea, is a refinery of the Anglo-Persian Company. It covers 650 acres, and has a model village attached. From Persia the crude oil is brought to Swansea in oil-tankers: three ships can discharge simultaneously to the transit tanks, whence the oil is pumped to Llandarcy.

In 1888 a select committee of the House of Lords was appointed to inquire into the subject of sweating. They found that the name was applied to: "(1) A rate of wages inadequate to the necessities of the workers, or disproportionate to the work done; (2) excessive hours of labour; (3) the insanitary state of the houses in which the work is carried on". They reported that, "As a rule, the observations made with respect to sweating apply, in the main, to unskilled or only partially skilled workers, as the thoroughly skilled workers can almost always obtain adequate wages".

The Trade Boards Act of 1909 was the result of a parliamentary inquiry into sweating, instigated in 1906 by Sir Charles Dilke, after a series of exhibitions had been organized by the Anti-Sweating League. This Act applied at first to four trades—chain-making, lace-finishing, box-making, and tailoring—but it has since been extended to others. It sets up boards, consisting of employers and workers in equal numbers, whose duty it is to fix minimum rates of wages for time- and piece-work in the trade concerned. The rates so fixed become obligatory, by order of the Board of Trade, six months after they have been made by the Trade Board.

For the benefit conferred on the workers by this legislation, see *Board of Trade Report* (H.C. 134).

Sweden (Sw. *Sverige*), a kingdom of North Europe, forming the eastern and largest political division of the Scandinavian Peninsula. For administrative purposes it is divided into twenty-five län or governments. The total area is 173,035 sq. miles (3500 being occupied by Lakes Vänern, Vättern, Mälaren, and Hjälmaren), and the population is about 5,904,000. Stockholm is the capital; other towns are: Göteborg (pop. 203,000), Malmö (113,500), Norrköping (58,000), Hälsingborg (47,000), Gävle (38,000), Örebro (36,000), Västerås (30,600), and Jönköping (30,000). Malmö, Göteborg, and Stockholm are the chief seaports.

Physical.—The old Scandinavian plateau falls in terraces to the Gulf of Bothnia. The great number and large volume of the Swedish rivers are explained by the character and position of the main watershed, and their general south-easterly trend is determined by the slope of the plateau. The terraces cause at least three falls or rapids in each river between source and mouth. Between Torneå (Tornio) and Gefle over sixty important rivers empty to the sea. The Plain of Scania, occupying the whole of the southern peninsula between the Sound on the west and the Baltic on the south and east, is the chief agricultural and industrial region. The chief lakes are Vener (area, 2014 sq. miles), Vetter (715 sq. miles), and Mälar, which has the capital on its shores. By canal, lake, and river there is an inland waterway—the Göta Canal—from the Kattegat to the Baltic. Sweden trends roughly from north to south, and the climate varies with the latitude, but generally the climate is dry and bracing; at Stockholm the average annual temperature is 42° F. The Baltic ports are frozen for many months of each year.

Communications.—There are over 9400 miles of railway in Sweden, two-thirds of the mileage being privately owned, and the remainder operated and controlled by the Government. All State lines are on the 4-ft.-8½-in. gauge, and the tracks are chiefly single. The State lines have a central administration, and comprise the northern trunk line (Stockholm and east coast) with many feeders, and a line, Bräcke-Östersund-Storlien, where a Norwegian line connects with Trondjem. Hydro-electric power is utilized in Lapland for the operation of the Luleå-Boden-Riksgränsen-Narvik (Norway) line, which is essential to the life of the iron-mines of this region, whose only outlet is by Narvik. Other State-operated trunk lines ex Stockholm run to Malmö, Göteborg, Christiania, &c. The eastern line to Luleå is continued via Boden to Haparanda, and through connection is provided for Finland and Petrograd via Tornio (q.v.). See also *Uleåborg*; *Uppsala*.

Production.—Activity is divided almost equally between industry and agriculture. An economic division of Sweden by a hypothetical line drawn east and west between the mouth of the Dal and that of the Klar would show a land of mining and forestry to the north, and a busy farming and factory region south of it. *Agriculture.*—Sugar-beet, fodder, rye, oats, and potatoes are important. *Mining.*—Iron, coal, sulphur pyrites, and zinc, copper, manganese, and argentiferous lead ores are chiefly mined. *Forestry.*—More than a half of the total area of Sweden is afforested, but the chief forestry region lies between 60° and 64° N. lat. Swedish timber and wood-pulp production is of world-wide importance. *Manufactures.*—The shores of the Gulf of Bothnia are the site of Sweden's chief sawmills. Domnarvet, Uddeholm, Sandviken, and Fagelsta produce pig-iron. Dairy supplies, telephone supplies, lighthouse apparatus, and machinery, porcelain, glass, paper, pasteboard, furniture, and chemicals are other representative manufactures.

People.—The inhabitants of Sweden, with the exception of the Laplanders and the Finns, found only in the north, belong to the Scandinavian branch of the Teutonic family. The Lutheran faith is recognized as the State religion, but other religions are tolerated. There are 5,500,000 Lutherans, 14,500 dissenters (Protestant), 3000 Roman Catholics, and 6000 Jews. Elementary education is free and compulsory between the ages of seven and fourteen years. There are two universities, Uppsala and Lund respectively.

Government, &c.—The crown is hereditary in the male line of the Royal House of Ponte Corvo. The king must be a member of the Lutheran Church. Legislative power is exercised, in concert with the sovereign, by the Diet, which alone is empowered to levy taxes. The Diet comprises two elective chambers. The First (or Upper) Chamber consists of 150 paid members, elected for nine years. The Second Chamber consists of 230 paid members, elected by universal suffrage for four years. Travelling expenses of the Deputies of both Houses are paid by the public purse. Executive power is in the hands of the king, under the advice of a Council of State consisting of about ten members, chiefly departmental heads. Stockholm is placed under a Governor-General, and each of the other län under a prefect, nominated by the king. *Currency, &c.*—The unit is 10 *kronor* gold; one *krona* = 100 *öre*: the par rate of exchange is kr. 18·16 = £1 sterling. The metric system of weights and measures is compulsory. *Defence.*—Military service between the ages of twenty and forty-two years: eleven years with the active army, four years in the second *Uppbåd*, and eight years in the Landstorm.

Each division comprises 2 two-regiment brigades (a regiment consisting of 12 battalions and 4 machine-gun companies), a cavalry regiment of 4 squadrons, 1 machine-gun company, and a field-artillery regiment of 11 four-gun batteries, &c. On mobilization 1 cavalry division of 4 regiments and 1 horse-artillery division are available. The infantry use the Mauser 6·5 mm. rifle; and Krupp 7·5 quick-firing guns are used by the artillery. All ships of the Swedish navy are maintained purely for coastal defence; and there are also land defences in charge of the Royal Coast Artillery.

History.—The history of Sweden before the union of Calmar in 1397 is rather obscure in its earlier part and rather confused throughout. Christianity was introduced by German missionaries in the ninth century, and the first Christian king, Olaf Skötkonung, ascended the throne about 1001, but for some time after there was a keen conflict between the Christian and the Pagan parties. One of the most notable men of this early time was Birger Jarl, a sort of mayor of the palace under Eric the Stammerer (1222–50), who gained so strong a position that he was able to place his son Valdemar on the throne in 1250. Valdemar was dethroned by his brother Magnus Ladulås (1275–90), a vigorous ruler and wise lawgiver. Sweden and Norway came under the same king in the person of Magnus Smæk, a nephew of Birger, in 1319, and with him began the series of events which led to the union of the three Scandinavian kingdoms under Margaret of Denmark and her nephew Eric of Pomerania (Eric XIII) in 1397.

Margaret died in 1412, and thereafter Eric XIII ruled alone, but his incompetence and oppression drove the Swedes to revolt under Engelbrekt Engelbrektsson, and in 1436 he was compelled to appoint Karl Knutsson as regent in Sweden. In 1448 Christian of Oldenburg became King of Denmark and Norway, but the Swedes proclaimed Karl Knutsson king; and after banishments and recalls he died King of Sweden in 1470. Sten Sture the Elder, a nephew of Knutsson, was appointed administrator in 1471, and King Christian was defeated in an attempt to enforce his claims. Christian died in 1481, and was succeeded by his son Hans, who invaded Sweden and established his authority in 1497. Sture was, however, recalled by the Swedes in 1500, and ruled till his death in 1503. Christian II succeeded his father Hans in 1513, and thrice invaded Sweden. Sten Sture the Younger was defeated and mortally wounded, and Christian (q.v.) was crowned at Stockholm in 1520. He signalized his coronation by wholesale executions, notably the Blood Bath of Stockholm, and in consequence a rebellion took place in 1521 under Gustavus Vasa, who in 1523 was proclaimed independent king of Sweden as Gustavus I (q.v.). He introduced the Lutheran religion as that of the State, and in 1544 he made the monarchy hereditary. He was succeeded by his eldest son, Eric XIV, a cruel and half-insane man, who was deposed in 1568 by his brother John. John ascended the throne as John III, and caused Eric to be poisoned in 1577. He concluded the Peace of Stettin, by which the separation of Sweden from Denmark and Norway was definitely ratified. John's son, Sigismund, who came to the throne in 1592, was brought up in the Catholic faith in Poland, but he undertook to maintain Protestantism in Sweden. He did not keep his promise, and was deposed in 1599, Duke Charles of Södermanland, youngest son of Gustavus Vasa, being appointed regent. In 1604 the regent was proclaimed king as Charles IX. On his death in 1611 his son, Gustavus II (Gustavus Adolphus), ascended the throne. This famous monarch, aided by his chancellor, Axel Oxenstjerna, reorganized the administration of the country, promoted industry, commerce, and education, and strengthened the army and navy. He negotiated the conclusion of wars begun by his father against Denmark and Russia, and played a great part in Germany as the champion of Protestantism during the Thirty Years' War (q.v.). He was succeeded by his daughter Christina. The Peace of Westphalia, which ended the Thirty Years' War (1648), added to Sweden Bremen, Verden, and a large part of Pomerania, while Sweden already possessed on the Russian side of the Baltic, Livonia, Esthonia, and other territories. Christina, who had left the real work of government to Oxenstjerna, abdicated in 1654, leaving as her successor Charles X, son of a sister of Gustavus Adolphus. Charles's short reign (1654–60) was mostly occupied by wars with Poland and Denmark. Charles XI, son of his predecessor, came to the throne at the age of four. The country was then long under a council of regency, but Charles assumed the government in 1672. He reorganized the army, adopting a regular system of conscription, and restored the finances. He died in 1697, and was succeeded by his son, the celebrated Charles XII (q.v.). Charles was succeeded by his sister, Ulrica Eleonora, who in 1720 resigned the government to her husband, Frederick I, Crown Prince of Hesse-Cassel. The absolute authority which the Crown had enjoyed under Charles XI and Charles XII was checked by the power of the nobles, and Sweden now lost most of her great oversea possessions—Livonia, Esthonia, Ingermanland, part of Finland, &c. The struggles of the Hats and Caps, the former a war party and the latter in favour of peace, began at this time. On the death of Frederick in 1751 Adolphus Frederick of Holstein-Gottorp was elected king. During his reign the country was distracted by the rivalries of the Hats and Caps, and the royal power sank to a shadow. Adolphus died in 1771, and was succeeded by his son, Gustavus III (q.v.), whose reign was distinguished by a monarchical revolution. He was assassinated in 1792. His son, Gustavus IV (q.v.), was deposed, and in 1809 his family declared for ever incapable of succeeding to the crown. His uncle, the Duke of Södermanland, was declared king with the title of Charles XIII (q.v.). Finland was finally ceded to Russia in 1809. In 1810 the states elected as Crown Prince, Jean Baptiste Bernadotte, (q.v.), Prince of Ponte-Corvo. In the final struggle with Napoleon previous to 1814 Sweden joined the Allies, while Denmark took the part of France. By the Treaty of Kiel (1814) Sweden ceded to Denmark her last German possessions in Pomerania, while Denmark was compelled to cede Norway to Sweden. Norway resisted the cession, and accepted Charles as king only when he had agreed to their free constitution as a separate state. Bernadotte succeeded to the crown in 1818, under the title of Charles XIV. He died in 1844, and was succeeded by his son, Oscar I (q.v.). He was succeeded by his son, Charles Louis Eugene, under the title of Charles XV, whose reign was marked by constitutional reforms. Charles XV died in 1872, and was succeeded by his brother, Oscar II (q.v.). In 1905 the union between Norway and Sweden was dissolved (see *Norway*). Oscar II died in Dec., 1907, and was succeeded by his son, Gustavus V (born 1858), the fifth sovereign of the House of Ponte-Corvo, and a great-grandson of Bernadotte. At his accession Sweden was overrun by Russian intelligence agents, and grave fears were expressed at the Russian concentration in Finland (formerly a Swedish possession), where railways were rapidly converging on the Swedish frontier, and barracks were springing up at every junction. A great wave of patriotism in the form of a national defence movement swept the country, and the reorganization of the national protective mechanism was proceeding apace at the outbreak of the European War. Strict neutrality having been declared, Sweden was early the focus of great stores and munition movements from abroad to Russia, and later became a central region for trade with the belligerents, particularly Germany. The stringency of the Allied blockade caused a great shortage, and a subsequent rationing of foods. Sweden joined the League of Nations, and was represented at the first meeting at Geneva (1920); her claim to the Åland Islands was rejected by the League in favour of Finland. The period 1905–14 was one of great commercial growth, but high wages, the eight-hour day, and the economic depression following the European War were reflected in a great industrial crisis during 1921–2.

Language and Literature.—The Swedish language is akin to Danish and Norwegian, being a descendant of the ancient Norse, the original of the Scandinavian branch of the Teutonic tongues, of which the purest representative at the present day is the Icelandic (see *Scandinavian Languages*). The earliest writings extant are the ancient provincial laws and the oldest ballads, which belong to the thirteenth century. In the fourteenth century translations of the chivalric romances of Southern Europe were introduced, and were followed by Biblical and theological translations and chronicles. The University of Uppsala was founded in 1478, and printing was introduced into Stockholm in 1483. During the sixteenth century the literature, influenced by the Reformation, was chiefly polemical. The earliest translation of the New Testament (1526) was by Olaus Petri, whose brother, Laurentius, the first Protestant archbishop of the kingdom, translated the Old Testament, published in 1541. A Swedish chronicle, *Svensk Krönika*, was written by Olaus and revised by his brother. Olaus also attempted the drama. The Thirty Years' War exercised a very favourable influence on Swedish literature. Several libraries captured by Gustavus Adolphus were sent into Sweden, and his daughter Christina became a liberal patron of literature, and brought many learned men to the country. The seventeenth century was chiefly characterized by the dramas of Messenius, and by the didactic and other poems of Stjernhjelm, 'the father of Swedish poetry' (1598–1672). In the eighteenth century French and English literature had much influence on that of Sweden. Olof von Dalin (1708–63) now took the chief place in verse and prose, other poets being Hedvig Charlotta Nordenflycht, Creutz, and Gyllenborg. Among the great names of this century in science are those of Swedenborg (1688–1772), Linnæus (1707–78), Torbern Olof Bergman (1735–84), Karl Wilhelm Scheele (1742–86), Celsius (1701–44). Karl Mickel Bellman (1740–95) was a song-writer of great merit. Mörk (1714–63) was the first Swedish novelist. Berzelius (1779–1848), one of the first chemists of his age, belongs essentially to the nineteenth century, as do Tegnér (1782–1846), Bishop of Vexiö, the greatest name in Swedish literature, whose *Story of Frithiof* was translated into every European language; Frederika Bremer (1801–65), the Finnish poetess, whose stories were popular far beyond Sweden; and Runeberg (1804–77), the poet, who is preferred by many Swedes even to Tegnér. Among later writers are Zakris Topelius and Count Karl Snoilsky, poets; Rydberg, novelist and historian; Tor Hedberg, Selma Lagerlöf, and Hjalmar Söderberg, novelists; Per Hallström, dramatist and poet; and Strindberg, dramatist and novelist.

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Swedenborg, Emanuel, Swedish scientist and mystic, son of Jesper Swedberg, Bishop of West Gothland, was born at Stockholm in 1688, died in 1772. Educated at Uppsala University, he travelled afterwards and studied at Paris, Oxford, and Utrecht. In 1716 he was appointed by Charles XII assessor extraordinary in the Royal College of Mines, and in 1719 Queen Ulrica raised the Swedberg family to the rank of nobility, the name being changed to Swedenborg. In the discharge of his duties Swedenborg visited the mines of Sweden, Saxony, Austria, and Hungary. A work on the origin of things, followed by a treatise on mining and smelting (*Opera Philosophica et Mineralia*), was published in 1734 (3 vols.), and attracted much attention among the scholars of Europe. From 1736 to 1740 he travelled in Germany, Holland, France, Italy, and England, and after his return published the *Œconomia Regni Animalis* (Economy of the Soul-kingdom), which contains the application of the system of nature, unfolded in his philosophical works, to man. He was first introduced to an intercourse with the spiritual world in detail, according to his own statement, in 1743 at London. The eyes of his inward man, he says, were opened to see heaven, hell, and the world of spirits, in which he conversed not only with his deceased acquaintances, but with various distinguished men of antiquity. He resigned (1747) his office in the College of Mines, and subsequently resided much in England and Holland. His theological works, written in Latin between 1747 and 1771, were not widely read; and although an object of the deepest veneration to his few followers, his statements were the more mysterious to the rest of the world because he could not be suspected of dishonesty, and exhibited profound learning, keenness of intellect, and unfeigned piety. His works are very numerous, among them being the *Arcana Cœlestia, The True Christian Religion, The Apocalypse Explained*, and *Heaven and Hell.*

Swedenborgians, the followers of Swedenborg, and particularly the members of what is called the *New Jerusalem Church*, or *New Church*. This body adopts the doctrinal tenets and method of Biblical interpretation laid down in the writings of Emanuel Swedenborg. The first attempt at organization took place in London in 1783, when John Flaxman, the sculptor, was among its members. The formal organization of the New Church took place in 1787, and Robert Hindmarsh was chosen to inaugurate the meeting. The first church for public worship was opened in Eastcheap, London, in 1788. Its great apostle was the Rev. John Clowes, rector of St. John's Church, Manchester. The belief of the Swedenborgians is: that Jesus Christ is God, in whom is a trinity not of persons but essentials, answering to the soul, body, and the operation of these in a man; that the Scriptures contain an internal or spiritual meaning, which is the Word existing in heaven; that the key to this is the correspondence between natural and spiritual things, as between effects and their causes; that man is saved by shunning evils as sins and leading a life according to the ten commandments; that man is a spirit clothed with a natural body for life on earth, and then when he puts it off at death he continues to live as before but in the spiritual world, first in an intermediate state between heaven and hell, but afterwards, when his character whether good or evil becomes harmonious throughout, among his like either in heaven or hell; that the Lord's second coming and the last judgment are spiritual events which have already taken place. The Swedenborgians have 75 places of worship in Great Britain, with about 6700 members (1922). —BIBLIOGRAPHY: W. White, *Emanuel Sweden-*

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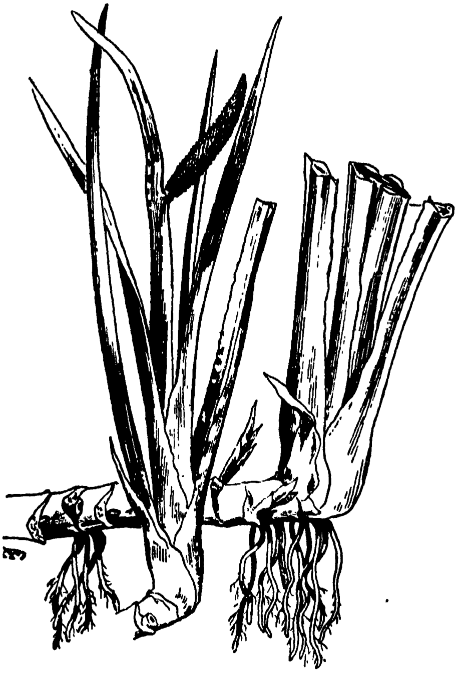
Sweet-briar, or **Sweet-brier** (*Rosa rubiginosa*), a species of rose, a native of Britain, which grows wild, but is often planted in hedges and gardens on account of the sweet balsamic smell of its small leaves and flowers. It is also called the *eglantine*.



Sweet-flag (*Acŏrus Calămus*)

Sweet-flag (*Acŏrus Calămus*), a plant, also called *Sweet-rush*, found in marshy places throughout the northern hemisphere. The leaves are all radical, long, and sword-shaped; the stem bears a lateral, dense, greenish spike of flowers; the root is long, cylindrical, and knotted. The root has a strong aromatic odour, and a warm, pungent, bitterish taste, and has been employed in medicine since the time of Hippocrates. It is also used by confectioners as a candy, and by perfumers in the preparation of aromatic vinegar, hair-powder, &c.

Sweet-pea (*Lathy̆rus odorătus*), a garden plant belonging to the nat. ord. Leguminosæ, and the sub-order Papilionaceæ. It is cultivated on account of the beauty of its flowers, which are sweet-scented, and in colour purple, rose, white, or variegated. Sicily is said to be its native place.

Sweet-potato (*Ipomœa Batatas*; nat. ord. Convolvulaceæ), a plant now cultivated in all the warmer parts of the globe. Formerly the roots were imported into England from the West Indies by way of Spain, and sold as a delicacy. It is the potato of Shakespeare and contemporary writers, the common potato being then scarcely known in Europe. The consumption of the sweet-potato is very large in many parts, including the United States and the warmer parts of America, the East Indies, &c.

Sweet-william (*Dianthus barbatus*; nat. ord. Caryophyllaceæ), a species of pink, an old inhabitant of the flower garden, which has produced numerous varieties. It grows wild in dry and sterile places in Middle and Southern Europe.

Swell, in music, a gradual increase and decrease of sound; the crescendo and diminuendo combined, marked by the sign <>. Also an arrangement in an organ (and in some harmoniums) whereby the player can increase or diminish the intensity of the sound at will. In the organ it consists of a series of pipes with a separate keyboard, and forming a separate department (called the swell-organ). The loudness or softness of the tone is regulated by opening or shutting, by means of a pedal, a set of slats like a Venetian blind, which forms part of the frame in which the pipes are enclosed.

Swetla, or **Svĕtlá**, a town of Bohemia, Czecho-Slovakia, on the Sazawa; served by the main-line railway Děčin (Ger. *Tetschen*)-Vienna and the branch-line Swetla-Rattay. Glass- and starch-making and the cutting of precious stones are the chief industries. Pop. 5000.

Swift, Jonathan, British satirist and Dean of St. Patrick's, Dublin, was born on 30th Nov., 1667, and died on 19th Oct., 1745. He came of a Yorkshire family, several members of which had settled in Ireland. He was a posthumous child, and was educated at the expense of his uncle, Godwin Swift, who sent him at the age of six to Kilkenny School, where he met Congreve. At the age of fourteen he was entered at Trinity College, Dublin; he graduated B.A. not without difficulty four years later. In 1688 Godwin Swift died, and Swift became secretary to Sir William Temple, who was living in retirement at Moor Park, near Farnham. This position brought him early into touch with prominent politicians, but seemed to be a blind-alley occupation. In 1694 Swift left his patron, being dissatisfied with his prospects, went to Ireland, was ordained deacon and priest, and on Temple's recommendation was presented to the prebend of Kilroot, near Carrickfergus, County Antrim. While there he carried on a love-affair with a Miss Jane Waring ('Varina'), of Belfast; four years later he ended their correspondence with a harsh letter. He returned to Moor Park in 1696, and found himself more appreciated for having been 'lack'd and lost'. He remained there until Temple died (1699). During his stay at Moor Park he spent much of his time with Esther Johnson ('Stella'), who when he met her first was a child of eight, being fourteen years younger than Swift. Swift proceeded to Ireland with Lord Berkeley, who, after disappointing Swift twice, presented him to the living of Laracor, near Trim, together with two other small livings, and the prebend of Dunlavin, in St. Patrick's. Stella and her friend Rebecca Dingley soon migrated to Ireland, where Swift saw the former frequently, but always in the presence of a third person. In 1701 he graduated D.D. at Dublin, and in 1704 he published anonymously *The Tale of a Tub*, which had been written in 1696; to it was appended *The Battle of the Books.* In 1708 appeared, among other things, an attack upon astrology under the title of *Predictions for the Year 1708, by Isaac Bickerstaff, Esq.*, and in 1709 *A Project for the Advancement of Religion*, dedicated to Lady Berkeley, the only work to which he ever put his name. In 1710 he was in London, being engaged by the Irish prelacy to obtain a remission of the first-fruits and twentieths, payable by the Irish clergy to the Crown, and was introduced to Harley, afterwards Earl of Oxford, and to Secretary St. John, subsequently Lord Bolingbroke. Swift then openly joined the Tory party. He has been much blamed, especially by Whig writers, for his desertion of the Whigs, but to blame him is unfair. Though a Whig in matters of State, he was always a Tory in Church matters; and in his eyes temporal considerations were always outweighed by spiritual. He wrote many political tracts, of which two of the most important were *The Conduct of the Allies* (1711) and *The Barrier Treaty* (1712), which were invaluable to the Tory party, preparing the mind of the country for the peace which the ministers were then anxious to bring about. For his party services Swift desired an English bishopric; but *The Tale of a Tub* was a fatal obstacle, and the only preferment he obtained from his ministerial friends was the Irish deanery of St. Patrick's, to which he was presented in 1713. The quarrels between Oxford and Bolingbroke, whom he vainly attempted to reconcile, and the death of the queen, which soon followed, put an end to his prospects, and condemned him to unwilling residence for life in a country which he disliked, and which was as much a place of exile for him as Tomi was for Ovid. According to some of his biographers, Swift was privately married to Stella in 1716; others strongly deny this allegation. Whether there was or was not a formal ceremony scarcely whitens or blackens Swift's conduct, which is in either case inexplicable. In 1712 he had become acquainted in London with Hester Vanhomrigh ('Vanessa'), then a woman of twenty-two, interested in books. He guided her reading for some time, and she fell violently in love with him. She made no disguise of her feelings, and followed him to Ireland; he gave her no encouragement, and endeavoured to arrange a suitable marriage for her, but it was of no avail. The true story of Swift, Stella, and Vanessa is probably less dramatic than many of the extant versions of it. It is clear that Swift was not in the condition

> Of Macheath, between Lucy and Polly,
> Or Buridan's ass.

He merely esteemed Vanessa, but he felt for Stella all the affection which he was capable of feeling. The end of a painful situation came in 1723, when Vanessa wrote a letter to Stella asking her if she was Swift's wife. Stella gave the letter to Swift, who rode off and flung it down upon Vanessa's table without speaking. Vanessa died within a few weeks. Meanwhile Swift had become the idol of the Irish people by the publication of his *Proposal for the Universal Use of Irish Manufactures* (1720), and of *The Letters of M. B., Drapier* (i.e. Draper) in 1723. *The Drapier's Letters*, as they are usually called, awoke in Ireland, for better and for worse, the dormant spirit of nationality. Stella died in 1728, and after her death Swift lived a more retired life, and became more and more misanthropic and morbid. He did not, however, relax his efforts to better the miserable condition of the Irish, and dedicated a third of his income to charity. His influence in Ireland was paramount; when it was at its height, he got his servant to announce to some noisy star-gazers that the eclipse had been postponed by order of the Dean of St. Patrick's. The crowd, thinking him almost omnipotent, dispersed at once. His own mental eclipse he could not postpone. He became quite insane in 1742, and was with difficulty restrained from tearing out his eye. He grew at length quite tranquil, but sank into a state of idiocy which lasted for three years before it was ended by death. He bequeathed the bulk of his fortune to found a hospital for lunatics.

Turning from Swift's life to his writings, it is possible to mention only his principal works and a few of his innumerable pamphlets. He was a titanic pamphleteer; but although all his writings show ability of the highest kind, many are lacking in interest save to students of the minutiæ of early eighteenth-century history and politics. *The Tale of a Tub* is one of the best and most characteristic of Swift's writings. It is a brilliant satire on Roman Catholics and Puritans, nor does it entirely spare Swift's own Church, whose motto has ever been 'medio tutissimus ibis'. Many other subjects are satirized besides the Churches; critics and bad writers come in for their share of sarcasm. *The Battle of the Books*, a by-product of the Bentley-Boyle controversy, is a slighter piece, but its considerable merits are not lessened by the fact that Swift was on the wrong side. It is the source of the phrase 'sweetness and light'. *Gulliver's Travels* (1726) is by far the most famous of all Swift's works, and is one of the greatest books in the English language. Its satire becomes more scathing towards the end, the last book being the most powerful indictment of humanity ever penned. *Gulliver's Travels* is one of the most original of books. Its debt to Lucian and Rabelais is of the slightest. Dr. Johnson's criticism upon it that "when once you have thought of big men and little men, it is very easy to do all the rest" is one of the worst utterances of that great critic, who was ever more at home with talent than with genius. By a curious piece of irony, this most bitter of satires has become a nursery classic. To make an Ausonian cento from Juvenal's *Satires*:

> Ut pueris placeat facit indignatio librum.

A Complete Collection of Genteel and Ingenious Conversation satirizes the rudeness of would-be smart society. *Directions to Servants* is a good piece of irony, and shows how keen an eye Swift had for details, especially when disagreeable. *An Argument against abolishing Christianity* is a brilliantly ironical pamphlet; *A Letter to a Young Gentleman, lately entered into Holy Orders* throws considerable light on Swift's religious opinions. *The Drapier's Letters*, already mentioned, is a collection of powerful pieces of special pleading. The pamphlet usually called, for sake of convenience, *A Modest Proposal*, is perhaps the most ironical of all ironical writings. Swift's poems have merit, but not poetic merit. *Cadenus and Vanessa* and some of the poems addressed to Stella are among the most interesting. *On Poetry: a Rhapsody* is a very powerful piece; and *On the Death of Dr. Swift* is a witty and at the same time pathetic poem. Of his other works the *Journal to Stella* is the most important. It gives us an intimate account of Swift's life, and is besides an historical document of the greatest value. There are three striking characteristics of Swift's writing. He was highly original, owing little to any of his predecessors. He was indifferent to fame, publishing only one of the least of his works in his own name. His wisdom, which was great, was always practical; although so ardent a Churchman, he was always one of the children of this world. As regards style, his writing is wellnigh perfect. It is clear, precise and exact, and absolutely free from rhetorical devices. Swift has been blamed for being too much a misanthrope; but it would be just as fair to blame him for becoming insane. Thackeray very justly said of him: "An immense genius; an awful downfall and ruin! So great a man he seems to me, that thinking of him is like thinking of an empire falling."—BIBLIOGRAPHY: Sir Leslie Stephen, *Jonathan Swift* (English Men of Letters Series); J. Churton Collins, *Jonathan Swift: a Biographical and Critical Study*; H. Paul, *Men and Letters*; Sir Walter Scott, *Memoirs of Jonathan Swift*; Sir Henry Craik, *Life of Jonathan Swift*; W. M. Thackeray, *English Humorists of the Eighteenth Century*; J. Forster, *Life of Jonathan Swift* (incomplete—down to 1711 only).

Swift, the *Hirundo apus* of Linnæus and *Cypsĕlus apus* of modern ornithologists, family Cypselidæ. Though swifts are like swallows in many respects, their structure is almost entirely different, and they are now grouped with the humming-birds in a sub-order (Cypseli) of the Coraciiformes. The swift has all four toes directed forwards; it is larger than the swallow; its flight is more rapid and steady; and its scream is very different from the twittering of the swallow. It has the greatest powers of flight of any bird that visits Britain. Its weight is most disproportionately small to its extent of wing, the former being scarcely an ounce, the latter 18 inches, the length of the body being about 8 inches. Its colour is a sombre or sooty black, a whitish patch appearing beneath the chin. It builds in holes in the roofs of houses, in towers, or in hollow trees. It leaves Britain in August, having arrived from Africa early in May. The alpine swift (*C. melba*), a larger species, with the lower parts dusky white, has its home in the mountainous parts of Central and Southern Europe. A common North American swift is the so-called chimney swallow (*Chætūra pelagica*), which builds its nest in chimneys (see *Swallow*). The swifts or swiftlets of the genus Collocalia, which inhabit chiefly the islands of the Indian Ocean from the north of Madagascar eastwards, construct the edible birds'-nests which are used by Chinese epicures in the making of soup.

Swilly, Lough, an inlet of the Atlantic in the north of Ireland, which penetrates the county of Donegal for about 25 miles. It is a fine expanse of great depth, with an average width of 3 miles.

Swimming. The art of swimming and watermanship is one of the few things that cannot be taught by correspondence. While it is easy to learn to swim, those who learn young have the advantage of youthful confidence and ambition

Swifts

to stimulate their efforts during the somewhat tedious period of failure, and self-confidence is one of the great secrets of watermanship. The struggles of a non-swimmer in deep water are fairly prolonged, and this alone affords so much evidence of man's gift of buoyancy in water, that it may fairly be assumed that had man nothing of the so-called power of reasoning, he would no more drown in deep water (excepting possibly through fatigue) than does the average beast (horse, cow, dog, sheep, goat, &c.) which has never learned to swim, but has the instinctive gift of floating and propelling itself into safety in time of need. Even the cat, which by popular tradition has a most profound abhorrence of water in anything but milk, possesses this instinct; and were a human non-swimmer in the face of death to rely upon his natural buoyancy, and to keep his hands and arms *beneath* the water, he would at least possess an equal chance with the most accomplished expert in natation, either of rescue or of attaining some safety-point unaided. For swimming, the fundamental principle is man's ability to float on or near the surface of water, and all systems of propulsion have this as a necessary basis. In learning, the writer does not favour the system of belts in public baths, except in the case of very nervous children, as these do not inspire confidence in the ability of the learner personally to swim unaided, and progress is retarded at the very period when the greatest strides are necessary. More than that, to many ladies who take up swimming as a tonic-exercise and a body-beautifier the belt will not impart anything but increased ungainliness, which may prove hard to eradicate. Sea-water swimming is preferable for learners, as, on account of its density, it offers greater support to the swimmer, and in a pond or bath danger is reduced to a minimum. The company of good swimmers and an imitation of their methods is very helpful.

The Strokes: Breast.—This is a very useful stroke, and the one that should be acquired first. In life-saving it is widely used, and it possesses certain advantages over all other strokes that make it one of the best for everyday use. Vision ahead is clear. Leg and arm movements, positive (propulsive) and negative (recovery), are not synchronous, although nine-tenths of swimmers perform them as such. The positive arm movement should be complete as the movement of the legs is begun, and during recovery the muscles both of arms and legs should be allowed completely to relax. It should be remembered that the art of swimming is not a case-hardened method; all strokes may be improved, as may style also, to suit the individual. A movement of the arms vertically downwards, and recovery backwards in alignment with the body, is now favoured by some specialists, and can be recommended for ease and increased style. *Back.*—A good championship stroke. *Back Crawl.*—An inversion of the rhythm and movement of the crawl stroke. Back-stroke swimming has been revolutionized by its adoption, and it has been the means of creating new speed standards for back swimming. It is, however, a stroke that really must be learned young, say between ten and fifteen years. *Crawl.*—This is quite good up to about 150 yards, and is much favoured for championship use in the United States. *Trudgeon.*—This is properly *Trudgen*—after the first European user. It is a double over-arm stroke which is much favoured in Great Britain for championship work. *Trudgeon Crawl.*—A compound stroke favoured by J. G. Hatfield (cf. *Swimming and Swimming Strokes*, where there are elaborate illustrations). These are among the most important, but it must be admitted that they are indescribable either verbally or on paper. No two swimmers have identical strokes; they modify each known stroke to suit their individual requirements in speed, comfort, style, and staying-power, and a learner, having duly studied any one of the swimming strokes, must then suit himself as to how he performs it.

Style.—Three great factors combine to make a good swimmer, and of these comfort is perhaps the chief; the others are style and staying-power. Speed is purely a secondary consideration, and cannot be attempted until the other three are present in perfection. Comfort may be attained on a 'system', and, passing over emergency ailments such as cramp, there remains only one major source from which it is possible to expect discomfort, and that source is the lungs. Without proper systematic comfortable breathing there can be neither style, speed, nor anything else. It is perhaps in this matter that most uninstructed amateurs, especially among youths, go most sadly astray, and perform the operation of breathing after the manner of a blown beast, perpetually short-winded and gasping for breath. In certain swimming strokes, such as the crawl, the head is carried under water for short periods, and it must therefore be within the power of the swimmer to breathe, *not between strokes*, but only after the completion of a cycle of two or more. This should be studied from the outset, after the essential leg-action has been perfected. Generally, in modern free-style strokes, breathing is effected by flicking the head to the side during the recovery of the top arm; air is taken in through the mouth and expelled through the nostrils during the cycle of strokes that follows. However, in leisurely swims of middle and long distance, one breath to a stroke-cycle may have some advantages, although it has none whatever at racing pace. Style comes by practice, and especially by practice in the correct timing of strokes. For comfort in breathing, style is necessary. Staying-power is dependent upon physical development and lung capacity, but can be improved also by practice. However, if the stamina is not there and cannot be acquired by the individual, long-distance swimming is almost an impossibility, although in the main dependent upon the capacity of the muscles used in the favourite stroke.

Competition Swimming.—The distances to be swum may be stated as long, middle, and short. Short-distance swimming is a purely 'sprint' performance, and is much favoured in baths and ponds. In training for this the object is primarily speed, and this must be attained with the least possible effort, so that style, breathing, and all the rest become as one, and are mutually indispensable. For a distance of 100 yards, a distance about one-sixth or so more should be aimed at, so that the necessary speed may be maintained throughout the 100 yards, and a little reserve hidden away for the most important stretch in sprint-work—the last 10 yards. 100 *yards* and 100 *metres* are not one and the same thing. Middle and long distances resolve into contests of stamina plus speed. In such races at sea it is sometimes amusing to watch competitors who, head down, wander frequently from their course. Such competitors are usually baths-trained men who are accustomed to the long, coloured bottom- and side-lines of baths (Scotland, America generally, and England in parts), which enable them to steer a direct course. The moral is obvious. Again, in deep sea the resting of muscles may be more complete than in fresh-water swimming, on account of the greater density. During training all hardening of the muscles is to be avoided; they must be soft and supple, and cycling, &c., is therefore banned. Once the weaknesses of the individual are brought to notice by a stiff swimming-test, concentration may be made to eliminate them; practice, walking, and Swedish exercises will do the rest. Tobacco and alcohol are of necessity taboo. Practice should especially be devoted to the energizing of positive strokes and complete relaxation and rest in the negative or preparatory-return movements.

Swimming - bladder, Air - bladder, or **Sound** (of fishes), the names applied to a sac or bladder-like structure found in most, but not in all fishes, the chief office of which appears to consist in altering the specific gravity of the fish, and thus enabling it to rise or sink at will in the surrounding water. It has a *homology* or structural correspondence with the *lungs* of higher forms than fishes; but it has no *analogy* or *functional* correspondence with the lungs or breathing organs, save in the peculiar Dipnoi (q.v.) or mud-fishes, in which the air-bladder becomes cellular in structure, and otherwise assumes a lung-like structure and function. In its simplest condition it exists as a closed sac lying beneath the spine, and containing air or gases of different kinds. By the muscular compression of its walls the density of the contained gas is altered, and the specific gravity of the fish affected accordingly so as to change its position in the water. In most sea-fishes the gas which the swimming-bladder contains is oxygen, that in the air-sac of freshwater fishes being mostly nitrogen. Such fishes as the flat-fishes, represented by the flounders, soles, &c., have no swimming-bladder developed, and it may be absent in other forms, such as sharks, rays, lampreys, &c.

Swinburne, Algernon Charles, English poet and critic, was born in 1837, and died in 1909. He was educated at Eton, and at Balliol College, Oxford, where he did not graduate, though he took a second class in classical moderations, and won the Taylorian prize. In 1860 he published two tragedies, *The Queen Mother* and *Rosamond.* He visited Italy and made the acquaintance of Walter Savage Landor. In 1865 he published *Atalanta in Calydon*, considered by many his best work, and, even to lovers of Shelley and Keats, a revelation of the possibilities of English. *Poems and Ballads* (1866) attained notoriety as well as fame, some of the poems being considered improper. *Chastelard* (1865) was part of a Mary Queen of Scots trilogy, of which the other parts were *Bothwell* (1874) and *Mary Stuart* (1881). Swinburne's other poetical works include: *A Song of Italy* (1867); *Songs before Sunrise* (1871); *Tristram of Lyonesse* (1882); *A Century of Roundels* (1883); *Marino Faliero* (1885); *Astrophel and other Poems* (1894); *The Tale of Balen* (1896); and *Rosamund, Queen of the Lombards* (1899). Swinburne also wrote much literary criticism, all of great interest and value. He delighted in Elizabethan literature, and wrote on Shakespeare, Jonson, Chapman, and some of their contemporaries; but he also wrote upon more recent authors, such as Blake, Charlotte Brontë, and his great idol Victor Hugo. For the last thirty years of his life Swinburne lived a life of great retirement with his friend Theodore Watts-Dunton (q.v.). From 1879 onwards deafness made general society impossible for him. He died after an attack of influenza, followed by pneumonia.

Swinburne takes a high place among English poets. As a craftsman he effected in the technique of verse as notable a revolution as Palestrina brought about in music. He found English poetry fettered by iambic measures, and left it dancing gaily in dactylic and anapæstic metres. In fact he gave poetry its freedom, not the freedom of *vers libre* (which, it has been said, can no more be called free than sleeping in a ditch can be called free architecture), but that which comes from eager obedience to laws 'whose service is perfect freedom'. His metrical ingenuity is unsurpassed. Even when using what might be called a toy form of verse like the rondeau, he can write great poetry. It is as if a master-musician played the ocarina, and "in his hand the thing became a trumpet; whence he blew soul-animating strains". Swinburne's poetry is not, as hostile critics alleged, sound without sense; but the sound is always closely connected with the sense, and sometimes predominates over it. Swinburne is always a singer; he is never a preacher, a philosopher, or a pamphleteer. He derived much inspiration from other poets, and yet remained highly original. He grew poetry in the garden of his mind; he did not manufacture it by the machinery of his mental processes. As a critic he displayed genius rather than soundness, and is disliked by those who prefer infallibility to suggestiveness. His dicta illustrate the saying that "Out of the same mouth proceedeth blessing and cursing". As a man, Swinburne was a curious instance of one who developed with startling rapidity up to the age of twenty, and then remained fixed in his opinions and beliefs. Jonson has aptly described this type of man: "They are wits of good promise at first, but there is an *ingenistitium*; they stand still at sixteen, they get no higher".—BIBLIOGRAPHY: Paul de Reul, *L'Œuvre de Swinburne*; C. Watts-Dunton, *Swinburne at Home*; E. W. Gosse, *The Life of Swinburne*; J. Drinkwater, *Swinburne: an Estimate*; P. E. Thomas, *Algernon Charles Swinburne: a Critical Study.*

Swindling, or **Cheating**, in English criminal law, is the wilful imposition by a person for gain under pretence of fair dealing. The term includes all varieties of deception for gain against which people cannot guard by ordinary care, e.g. cheating at games, using false weights and measures, coining, obtaining money or goods by false pretences, falsification of accounts, personation, forgery, &c. Cheating at 'cards, dice, tables, or other game', whereby any sum of money or valuable thing is won from any person, is a misdemeanour. Every person who uses for trade a weight or measure which is not of the standard denomination, or which is false or unjust, is liable to a fine and, if fraud is involved, to imprisonment also. The offence of coining is punishable with penal servitude for life or imprisonment with or without hard labour. It includes counterfeiting, colouring, impairing, clipping, or filing current coin, and uttering, importing, or exporting counterfeit coin. To make or sell medals resembling current coin is a misdemeanour. To obtain money or goods by false pretences, or to induce anyone by false pretences to execute a deed, or to sign or endorse valuable securities, is likewise a misdemeanour. This offence has been committed if the party who was induced to part with his money or goods or to sign or endorse his name did so in consequence of words or conduct wilfully designed to mislead and defraud him by reason of the falsity of the words or conduct. The falsification of accounts by a clerk, officer, or servant with intent to defraud is punishable with penal servitude. Personation, i.e. the pretence of being someone other than one's self for the purpose of obtaining money, &c., is a crime of varying degree. To personate a seaman in order to receive his wages or allowances is punishable with penal servitude; to personate an army pensioner for the purpose of drawing his pension is punishable with two years' imprisonment; to personate an heir, executor, wife, or other relative in order to obtain any land, money, or other property is a felony punishable with penal servitude for life. Forgery is the making of a false document or of material alterations without authority, or counterfeiting a seal or die, and uttering it as genuine with fraudulent intent. To forge any will, deed, bank-note, or official seal is a felony punishable with penal servitude for life. Less serious forgeries are punishable with penal servitude not exceeding fourteen years or imprisonment. Forgery is commonly thought to consist in the unauthorized signing of another's name, but to alter any part of a document though the signature is genuine, or to place any unauthorized writing over a genuine signature, with fraudulent intent, is also forgery.

Swindon, a municipal borough, market town, and railway junction of Wiltshire, England. It consists of Old Swindon and New Swindon. Old Swindon, known in *Domesday* as *Swindune*, overtops New Swindon, which originated in the establishment (1841) of the locomotive works of the Great Western Railway, which provide the chief local employment. Pop. (1921), 54,920.

Swine Fever, or **Swine Plague** (known as hog cholera in America, where it has caused enormous losses), a specific contagious fever, generally rapid in its course, death ensuing in a very few days. To suppress the disease, all affected pigs must be killed, and if necessary those which have been in contact with them, and the carcasses and litter burned or deeply buried.

Swine in Religions. The religious treatment of swine differed among the peoples of ancient Europe and Asia. Lucian in his *De Dea Syria* (chap. liv), writing of the Galli, says: "They sacrifice bulls and cows alike and goats and sheep; pigs alone, which they abominate, are neither sacrificed nor eaten. Others look on swine without disgust, but as holy animals." In Crete pork was tabooed because Zeus had been suckled by a sow. The Greeks associated the pig with the goddesses Demeter and Aphrodite. In ancient Egypt swine were kept to eat roots and worms on newly tilled land, and to tread in the grain. Pork was not eaten except once a year, when a pig was sacrificed to the moon and Osiris. Set, the slayer of Osiris, was identified with the black demon-pig, and souls condemned in the Judgment Hall of Osiris were transformed into black pigs. Owing to its connection with Set, the pig acquired an evil reputation. Pork was tabooed for two reasons: (1) because the pig was a form of the mother-goddess, and (2) because it was a form of Set, the Egyptian devil. The Celts, like the Achæans, ate pork freely, but those who settled in Galatia came under the influence of the Attis cult and tabooed pork. A prejudice against pork still exists among the Christians of Northern Arcadia in Greece, and among sections of the Scottish Highlanders. Apparently the Celts who reached Scotland came under the influence of a cult which tabooed pork. There was formerly a 'sow day' in Northern Scotland when pork was eaten, as it was at the Demeter festival in Greece, and the Osirian and lunar festival in ancient Egypt. The god-boar, as well as the devil-pig, has been traced in Scotland. St. Kentigern (St. Mungo), Glasgow's patron saint, followed a white boar, and had a monastery erected on the spot where it tore up the soil with its tusks. On the 'boar stone' at Inverness a wild boar is associated with a solar symbol. One of the Pictish tribes was called the 'Orcs' (young boars). Bronze images of boars were worn on armour by various British tribes. Tacitus tells that the Baltic amber traders of Celtic speech believed that the image of the boar, 'the symbol of the mother-goddess' (apparently her son), protected warriors in battle. Christ stamps on the devil-pig on the Ruthwell Cross, Dumfriesshire, and in Scottish Gaelic the devil is 'the big black pig'. 'Were-pigs', referred to as 'man-pigs', figure in Scottish and Irish Gaelic tales. The Jewish, Muslim, and Hindu prejudice against pork is believed to have been of Egyptian and Babylonian origin. Tammuz, the Babylonian god, was associated with the pig. Among the ancient Chinese clay images the god of death stamps on a pig. The Malay peoples connected the pig with the cowry, and, like the Polynesians, believed in 'were-pigs' and in the supernatural pigs from the Underworld.

Swinemünde (svē′nė-mün-dė), a seaport and sea-bathing resort of Prussia, province of Pomerania, on the Island of Usedom, at the mouth of the Swine, the outport for Stettin. The harbour is one of the best on the Prussian Baltic coast. Pop. 13,914.

Swing Bridge, a type of bridge which revolves horizontally on a vertical axis which is commonly at its centre, but is sometimes at the end or in an intermediate position in the length. It is one type of movable bridge, the other types being: the *bascule bridge*, which is raised in a vertical plane; the *retractable drawbridge*, which is supported on wheels on tracks on the shore, and can be rolled out of position to permit the passage of traffic through the gap; *lift bridges*, which may be raised to allow passage beneath them; and *transporter bridges*, which are carriages slung from a high fixed structure. The common swing bridge is supported on a pier at the centre of the gap it crosses, and is turned on a circular track. It leaves a space at each side for the movement of traffic. Unequal arms are sometimes used when the width of the cutting is too small to permit the use of a central pier; and sometimes double swing bridges are installed to obtain the requisite clearance. The bearing may be upon the centre or upon the rim; in the latter case a rim of conical steel bearers is used. The bridges are usually turned by steam-engine or electric motor through a pinion and circular rack. When any pier would be an obstruction, some type of bascule bridge must be resorted to. See *Bridge*.

Swinton, an urban district and town of England, in the West Riding of Yorkshire. It is an industrial place, with pottery-works, glassworks, ironworks, coal-mines, &c. Pop. 18,900.

Swiss Guards, bodies of mercenary Swiss troops which, since Switzerland gained her independence in the fifteenth century, have been employed in many European countries as bodyguards, and for duty about courts. The most famous are the French Swiss Guards organized in 1616, and annihilated in the defence of the Tuileries, 10th Aug., 1792, whose heroism is commemorated in Thorwaldsen's colossal Lion, carved in the face of a rock at Lucerne. The French Swiss Guards were reorganized by Louis XVIII in 1815, and defeated and dispersed in the revolution of 1830. The Papal Guard (Guardia Svizzera) is another Swiss Guard, consisting of 110 men and 10 officers of Swiss nationality. They form the Papal guard of honour. The privates are not allowed to marry.

Switches and Switch-gear. For the purpose of connecting and disconnecting the generators to a supply system, and also the user's equipment to the distributing cables, conducting links which can be put into position in the circuit and drawn away are essential. They range from the simple tumbler switch for operating one or two lights to the heavy equipment used in power-stations. In every case the certainty that complete rupture of the circuit takes place in opening is an essential requirement, and, in consequence, springs are much used to pull the switch-arm into a safe position at every breaking of the circuit. The action must be performed suddenly, or arcing between the contacts and switch will ensue, accompanied by destruction of the metal. For motors working with electricity supply at dangerous pressures, the operating switch is commonly enclosed in an iron box, which is held closed by a catch whenever the switch is on. Large switches in supply-stations are usually arranged to break under oil. When they control high-tension supplies, the actual switch is fitted at the back or below the switch-board in a brick chamber, the actual opening or closing being effected by the use of systems of levers, or by means of electrical relays. The contact areas of switches must be proportioned to the current to be broken, as overheating at those places might make the switch inoperative and be the cause of damage.

Automatic switches or current-breakers serve more than the same purpose as a fuse, although the excess-current type performs similar functions, but with greater certainty. Other types are used to prevent the passage of current back from the supply-system to a generator when running light. They are also designed to serve in the cause of safe working in many other ways. In a supply-station all the switches and instruments are brought to a switch-board built up of separate panels for each machine and for each main cable or feeder.

Swithin, St., Bishop of Winchester from 852 to 862, and patron saint of Winchester Cathedral from the tenth to the sixteenth century. The popular knowledge of this saint's name is due to the belief that if rain falls on the 15th of July (which is popularly known as St. Swithin's Day) it will rain for six weeks after. Similar superstitions are connected in various Continental countries with other saints' days which occur in summer.

Switzerland (Ger. *Schweiz*; Fr. *Suisse*), a federal republic of Central Europe, comprising the following cantons:

Cantons.	Area in sq. m.	Population.
Aargau (Fr. Argovie)	542	240,780
Appenzell	162	69,970
Basel (Fr. Bâle)	177	223,000
Bern (Fr. Berne)	2,657	674,390
Freiburg (Fr. Fribourg)	644	143,060
Gall, St. (Ger. Sankt Gallen)	780	295,540
Geneva (Fr. Genève; Ger. Genf)	109	171,000
Glarus (Fr. Glaris)	267	33,840
Grisons (Ger. Graubünden)	2,774	119,850
Lucerne (Ger. Luzern)	580	177,070
Neuchâtel (Ger. Neuenburg)	312	131,350
Nidwalden } Unterwalden	112	13,960
Obwalden	183	17,570
Schaffhausen (Fr. Schaffhouse)	116	50,430
Schwyz (Fr. Schwytz)	351	59,700
Solothurn (Fr. Soleure)	303	130,620
Thurgau	382	135,930
Ticino (Ger. and Fr. Tessin)	1,088	152,260
Uri	415	23,970
Valais (Ger. Wallis)	2,026	128,250
Vaud (Ger. Waadt)	1,245	317,500
Zug	92	31,570
Zürich	665	538,600
Total	15,982	3,880,210

For political purposes three cantons are divided, viz. Basel into Stadt and Land divisions, Appenzell into Ausser Rhoden and Inner Rhoden, and Unterwalden into Nid- and Obwalden.

The city of Bern is the federal capital; other towns are: Zürich, Basel, Geneva, St. Gallen, Lausanne, Winterthur, Lucerne, La-Chaux-de-Fonds, Biel, Neuchâtel, Freiburg, and Schaffhausen. These have all a population of over 20,000, and are arranged in order of importance. Bern is fourth in population.

Physiography.—Switzerland is the most mountainous country of Central Europe. It possesses a central plateau, flanked by the Jura and the Alps (q.v.), and from a node on the St. Gotthard massif the drainage of the country is swept away to three different seas. The Rhine with the Aar, the Rhône with the Arve, the Ticino (to the Po), and the Inn (to the Danube) are the chief rivers. Of the many lakes, Geneva is the largest, but, like Constance and Maggiore, it is only partly in Switzerland. Lakes entirely within the country include: Neuchâtel, Morat, Bienne, Thun and feeder, Sempach, Baldegg, Zug, Zürich, and Lucerne. All internal lakes belong to the Rhine basin. Climatically Switzerland has no standard, the altitude and other modifying factors (such as the lakes around the central plateau) giving rise to conditions peculiar to each particular place. See *Alps.*

Production.—Few countries in Europe can boast of a more varied vegetation than Switzerland, which may be divided by plant characteristics into seven regions. These are: (1) the vine, found up to 1700 or 1800 feet altitude; (2) the hilly or sub-montane region, of 2800 feet altitude, characterized by the luxuriance of its walnut trees, good crops of spelt, and excellent meadows; (3) the upper mountain region, which has its limit at 4000 feet altitude, and produces forest timber, especially beech, some barley and oats, and possesses fine pastures; (4) up to 5500 feet altitude, the sub-alpine region, where no regular crops are raised, but pine and maple forests abound; (5) the lower-alpine region, up to 6500 feet altitude, an area of alpine pastures; (6) the upper-alpine region, with stunted growth of deciduous plants and the loss of seasonal variation; (7) the region of eternal snow. Agriculture is limited, and home production is totally inadequate. Even the mineral wealth is very limited (marble, asphalt, and rock-salt mainly); but Switzerland has become a thriving industrial country by importing raw materials and converting the potential energy of her numerous streams into cheap hydro-electric power. Hardwares are typically French, and are followed in the south-west (e.g. Geneva and Neuchâtel); textiles are typically German, and are followed in the north-east (e.g. Basel and Zürich). Leather goods and chemicals are also produced, but 86·5 per cent of all manufactures are textiles. Another important industry is the utilization of surplus milk by conversion into Gruyère cheese, chocolate, &c.

Social Conditions: People.—Switzerland is an example of a state that is not a nation. In nineteen out of twenty-five cantons German is the common language; French is confined to Freiburg, Vaud, Valais, Neuchâtel, and Geneva; and Italian to Ticino. Romansch, or Rhætian, is spoken by some 40,000 people. *Religion.*—Religious liberty is assured, but Jesuits and such societies are banned, as is the foundation of new monastic houses or orders. The State may deal summarily with religious organizations that become dangerous to the common weal. 57 per cent of the population are Protestant, and have a majority in twelve cantons; 41 per cent, with a majority in ten cantons (including Ticino, the Forest cantons, Valais, Lucerne, and Freiburg), are Roman Catholic. The Protestant Church is Calvinistic in doctrine, and is controlled by the magistrates of the cantons. Four bishops, who are immediately responsible to Rome, have spiritual headship over the Roman Catholics. *Education.*—Primary education is secular and compulsory throughout the confederation, but it is not centralized, and although rigidly enforced in the Protestant cantons, it is only nominal in those of Roman Catholic faith. There are seven universities, and a Polytechnic School at Zürich. *Currency, &c.*—The monetary unit is the *franc*, divided into 10 *batzen* and 100 *rappen* (centimes). Normal exchange is 25·22½ *francs* = £1 sterling. The metric system of weights and measures is the only legal system.

Government.—The cantons of Switzerland are united together as a federal republic for mutual defence, but retain their individual sovereignty in all matters affecting cantonal administration. The legislative power of the confederation is vested in a Federal Assembly, and the executive power in a Federal Council. The Federal Assembly comprises a National Council (189 members, each representing 20,000 souls) and a State Council (44 members, two elected by each canton and remunerated by arrangement). The political divisions enumerated in the opening table come into play in the election of Senators, each subdivision sending a member to the State Council. The franchise is open to every citizen over twenty-one, and any voter except a clergyman may become a Deputy. The referendum (q.v.) and initiative form part of the federal constitution and also of the constitutions of most of the cantons. The Federal Council consists of 7 members, elected for three years by the Federal Assembly, and they assume individual charge of the seven administrative departments of the Republic. The president and vice-president of the Federal Council, elected for one year by the Federal Assembly, are the chief magistrates of the Republic. The

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Federal Tribunal (14 members, elected for six years by the Federal Assembly) decides all intercantonal or cantonal-confederate disputes, and acts in general as a high court of appeal. It is divided into a civil and a criminal court. *Defence.*—Conscription to the national militia between twenty and forty-eight years is compulsory, infantrymen serving twelve years with the Auszug, eight Landwehr, and eight Landsturm; cavalry have eleven years Auszug and twelve Landwehr. There are six divisional districts; and a total of 200,000 fighting troops is estimated: 106 battalions with eight 3-squadron cavalry regiments and 12 squadrons of guides provide the striking arm. There is an air force. The infantry armament is the Swiss repeating rifle, and the artillery have the Krupp quick-firing gun (shielded), 7·5 cm. calibre.

Communications.—There are over 3000 miles of State railways in Switzerland, and the abundant supply of cheap water-power has promoted an all-electric policy which is pursued whenever possible. One of the main Swiss lines runs along the Rhône Valley as far as Brig (see *Systems, Railway*, paragraph 6). From Brig there is an extension, via Münster, as far as Gletsch (29 miles), the station for the Hasli Thal and the Rhône glacier. The St. Gotthard trunk line runs to Bellinzona (see *Uri*), whence there is a feeder running up the Valle Mesolcina to Lostallo and Mesocco (20 miles). Further lines run via Giubiasco (2½ miles), whence Locarno (12 miles), Lugano (20 miles), and Luino (24 miles, on the east shore of Lake Maggiore) are served. Lausanne is a considerable railway centre on the north side of the Lake of Geneva, whence lines radiate to Geneva, Freiburg and Bern, and Lyss (via Polezieux, Payerne, and Murten). Freiburg and Payerne are both served by the line to Yverdon on Lake Neuchâtel. Basel to Lucerne (60 miles), via Olten (for Bern and Aarau), is important. Basel to Olten is 25 miles; Olten to Aarau is 81 miles; and Olten to Bern is 41 miles. From Aarau, Brugg (11½ miles) may be reached, whence lines lead to Basel (36 miles), Zurich (30 miles, via Baden). Another line from Aarau is that running to Arth-Goldau (40 miles), via Lenzburg, along the valleys of the Bünz and Lorze to Rotkreuz (29 miles, a junction for Lucerne); thence by the west shore of the Lake of Zug to Arth.

History.—The oldest inhabitants mentioned in written history are the Helvetii (q.v.), who, between 58 B.C. and A.D. 10, were subjugated by the Romans. Before the fall of the Roman Empire in the West, Switzerland was occupied by the German confederation of the Alemanni; by the Burgundians and the Lombards; and by the year 534, under the successors of Clovis, it had become a portion of the Frankish Empire. Under the successors of Charlemagne it was divided between the Kingdom of France and the German Empire, but ultimately the whole country fell to Germany. For the most part, however, the dependence of Switzerland on Germany was merely nominal. The counts (originally local governors) conducted themselves as princes, assumed the name of their castles, and compelled the free inhabitants of their *Gaus* (districts) to acknowledge them as their lords. At the beginning of the thirteenth century the three forest cantons of Uri, Schwyz, and Unterwalden were subject to the Counts of Habsburg, who, although they were properly only imperial bailiffs (*Vögte*), yet regarded themselves as sovereign rulers. This claim the three cantons constantly refused to admit, and eventually (1291) leagued themselves together to oppose the usurpation of the House of Habsburg. Tradition says that on the night of 7th Nov., 1307, thirty-three representatives, with Fürst of Uri and his son-in-law Tell, Stauffacher of Schwyz, and Arnold of Melchthal in Unterwalden at their head, met at Rütli, a solitary spot on the Lake of Lucerne, swore to maintain their ancient independence, and projected a rising of these cantons for the 1st Jan., 1308. On the day fixed the rising took place, and the Austrian governors were deposed and expelled. But the events related of Tell are purely legendary. A few years later the three cantons were invaded by the Habsburgs; but the signal victory at the pass of Morgarten on the 15th of Nov., 1315, secured their independence. The three united cantons were joined by the cities of Lucerne (1332) and Zürich (1351), the cantons of Glarus and Zug (1352), and the city of Bern (1353). Austria, which claimed jurisdiction over three of the newly added members, namely, the city of Lucerne and the cantons of Glarus and Zug, again invaded the territory of the confederation, but was completely defeated at Sempach, where Arnold of Winkelried is said to have sacrificed his life for the sake of his fellow-countrymen (1386), and (1388) at Näfels. The canton of Appenzell joined the confederation (1411), and Aargau was wrested from the Austrians (1415). The third war with Austria terminated in 1460. in favour of the confederation, which obtained Thurgau, Austria being thus deprived of all its possessions in the regions over which Switzerland now extends.

Struggle with Burgundy.—In 1474, at the instigation of Louis XI of France, the Swiss turned their arms against Charles of Burgundy, invading his country and defeating his army near Héricourt. Charles, in revenge, invaded Switzerland, but the Swiss were again completely victorious, and inflicted several defeats upon the Burgundians at Granson in Vaud and at Murten (Morat) in Freiburg (1476), and at Nancy (1477), where Charles was slain. Freiburg and Solothurn were admitted into the confederation (1481), and defensive alliances were concluded with neighbouring states. Their prosperity rose to such a height that all the adjacent courts, even Austria, sought their friendship and alliance. The last war with Austria broke out in 1498. The Swiss had a severe struggle, but, victors in six sanguinary battles, they were, by the Peace of Basel (1499), practically separated from the empire, a separation to which formal and international sanction was given in 1648. After this war they had no longer any enemy to fear, and their future wars were waged on behalf of foreign Powers. In 1501 Basel and Schaffhausen, and in 1513 Appenzell (which had long been an ally), were admitted into full federation. The number of cantons was thus brought up to thirteen, at which it remained till 1798. The town and the abbot of St. Gall and the town of Bienne had seats and votes in the Diet without being in full federation; and there were besides six allies of the confederation not enjoying these privileges—the Grisons, Valais, Geneva, Neuchâtel, Mühlhausen, and the bishopric of Basel. In 1516 France gave up to Switzerland the whole of the present canton of Ticino.

The Reformation.—In 1518 the Reformation began to make its way into Switzerland, chiefly through the efforts of Zuinglius at Zürich. Zuinglius fell at Kappel (1531), but his work was carried on by Calvin at Geneva. The effect of the Reformation for long was to divide Switzerland into separate camps. Aristocracy and democracy, Protestantism and Catholicism, struggled for the superiority. Internal dissensions, religious and political, continued for nearly two hundred years. The last time the two great parties met in arms was at Willmergen in 1712, when victory declared itself for the Protestants. The period of tranquillity that followed was alike favourable to the progress of commerce, agriculture, and manufactures, and to the arts and sciences.

Democratic Movement.—At the end of the eighteenth century the ferment of the French Revolution spread to Switzerland; and in 1798 the ancient confederation was replaced by the Helvetic Republic, which lasted four years. In 1803 Napoleon I organized a new confederation, composed of nineteen cantons, by the addition of Aargau, Grisons, St. Gall, Ticino, Thurgau, and Pays de Vaud. In 1815, by the compact of Zürich, Neuchâtel, Geneva, and Valais were admitted into the confederacy, and the number of cantons was thus brought up to twenty-two. This confederacy was acknowledged by the Congress of Vienna (1815), which proclaimed the perpetual neutrality of Switzerland, and the inviolability of its soil. In 1847 a separatist league of seven Catholic cantons (the Sonderbund) had to be dissolved by force of arms, and next year a new Federal constitution was introduced. During the commotions of 1848 Neuchâtel set aside its monarchical form of government and adopted a republican one, and in 1857 it was put upon the same footing with the other cantons. Since that time the annals of Switzerland have little to record beyond the fact of constant moral and material progress. A revision of the Federal constitution was adopted after a protracted agitation on the 19th of April, 1874, giving to the Federal authorities more power in matters relating to law, the army, the Church, and education.

Literature.—Switzerland, on account of the linguistic diversity of the country, has no national literature. The works of the eminent Swiss authors belong either to French or to German literature. Attempts, however, were made in the nineteenth century to create a Romansch-Latin literature, the most prominent poet being Anton Huonder. The characteristic trait of Swiss literature, whether employing as its vehicle of expression the French or the German language, is that of being, for the most part, Protestant. Conscience, reflection, and a sense of duty predominate over sentiment, imagination, and a sense of beauty.

Before the Reformation Swiss authors wrote either in Latin or in German. Ballads, lieder, war songs, and historical chronicles have come down to us. Berthold Steinmar and Hans Hadlaub (1250–1325) are the most prominent among the Swiss minnesingers; Halbsutter wrote the *Song of Sempach*, whilst in the fifteenth century appeared the *White Book of Sarnen* and the *Tellenlied*. The Swiss reformers and humanists wrote either in Latin or in German. The Bernese Nicholas Manuel (1484–1530), the most remarkable poet of the Swiss Reformation, criticized in German the Pope and the Catholic clergy. The sixteenth century produced the historians Jean Stumpf (1500–76) and Ægidius Tschudi (1505–72); the philologist and mathematician Sebastian Münster (1489–1552); and the bibliographer and zoologist Conrad Gesner (1516–65), author of *Historia Animalium*. During the eighteenth century a Swiss school of literature arose in German Switzerland with J. J. Bodmer (1698–1783) and J. J. Breitinger. They criticized the views of Gottsched, broke with the traditional French classicism, and recommended the study of the English poets, as nearer akin to the national Swiss genius. The Bernese poet Albert von Haller (1708–77) preached a return to nature, whilst the philosopher Iselin (1728–83) was a precursor of Herder. During this century Switzerland also produced the great mathematicians Euler (1746–1827) and the Bernoullis, and the educational reformer Pestalozzi. Among prominent German-Swiss authors of the nineteenth century are: Albert Bitzius (1797–1854), known under the pseudonym of Jeremias Gotthelf, who described the rustic life of his native land; Gottfried Keller (1819–90), novelist and poet; and Conrad Ferdinand Meyer (1825–98), who chose ancient Rome, the Middle Ages, and the Renaissance as subjects for his artistic compositions. Of more recent German-Swiss writers may be mentioned Ernest Zahn and Carl Spitteler (1845).

The French language has been employed in Switzerland since the thirteenth century, but it is only since the Reformation that important literary works have been produced in French Switzerland. The first writers were preachers and theologians, such as Farel and Viret, the historian Bonivard, and the poet Blaise Hory. After the revocation of the Edict of Nantes, a number of cultured Frenchmen came to Switzerland, and Louis Bourguet (1678–1754) founded the *Mercure Suisse* (1732), to which Ph. C. Bridel (1757–1845) contributed important articles. The latter also wrote *Poésies Helvétiennes*. In 1796 the brothers Pictet founded the *Bibliothèque Britannique*, which was succeeded by the *Bibliothèque Universelle*. Rudolf Töpffer (1799–1846), author of *Nouvelles Genévoises* and *Voyages en Zigzag*, founded the *Courier de Genève* in 1841. The *Journal de Genève* appeared in 1826, and the *Revue Suisse* in 1838. To the same period belong the philosopher Bonstetten; the national poet A. Richard (1801–81); Petit-Senn (1792–1870); the moralist Henri Amiel (1821–81); the literary historian Alexandre Vinet (1797–1847); the poet Juste Olivier (1807–76); and Eugène Rambert (1830–86), author of *Alpes Suisses*. Among more recent French-Swiss authors are: Edouard Rod (1857–1910); Isabelle Kaiser; Philippe Monnier; and J. V. Widmann (1842–1911), poet, dramatist, and novelist, author of *La Patricienne* and *Esquisses Italiennes*.—Cf. V. Rossel and H. E. Jenny, *Histoire de la littérature Suisse*.

European War.—On the outbreak of the European War the chief aim of the nation was to preserve the independence and integrity of the country, but the Government had to face a difficult situation. The mobilization of the army necessitated excessive expenditure, and the maintenance of neutrality imposed heavy burdens. War loans had to be floated, and special war taxes were authorized by a referendum. Public services were put to a severe test, and steps had to be taken to avert an economic crisis. As the war continued, Switzerland experienced considerable difficulty in maintaining her strict neutrality, as German intrigues and influence increased in the country and gained the sympathies of the German Swiss. Obliged to work and carry on trade with opposing belligerents, the Government frequently found itself in a very difficult position. Thus it had to reject a petition from the cantons of Geneva, Vaud, and Neuchâtel urging the Federal Council to protest against the deportation of Belgians and French by the Germans. Suffering as the country did from economic difficulties, it concluded an Economic Convention with Germany in Sept., 1916, by the terms of which Switzerland promised to supply Germany with cattle and cheese, and Germany to supply Switzerland with coal and coke. Switzerland also promised to stop exportation to the Entente Powers of ammunition and explosives in the making of which German material had been used. In 1917 Switzerland suffered severely from a scarcity of food supplies, and the Government protested against the new German submarine warfare, but it did not sever its relations with Germany. Rumours also spread that Germany was about to invade the country, and the Federal Government at once took measures to place the country on her guard. Generally speaking, the sympathies of the Swiss nation during the European War were divided. The German-Swiss, constituting the majority, were on the side of Germany, whilst French and Italian cantons were in favour of the Entente Powers. As for the Swiss Government, it pursued a policy based on the fear of Germany and inspired by a belief in and expectation of Germany's final victory. In consequence of her central position, the country was, on the other hand, able to render considerable humanitarian services to all belligerents, facilitating the exchange of disabled prisoners. Where it was a question of charity, Switzerland, French and German, was united. During the war the country also became a convenient meeting-place for peace conferences. Thus a Socialist conference was held at Zimmerwald on 15th Sept., 1915, when a manifesto was issued to the European proletariat, and on 17th May, 1917, another Socialist conference took place at Kienthal.

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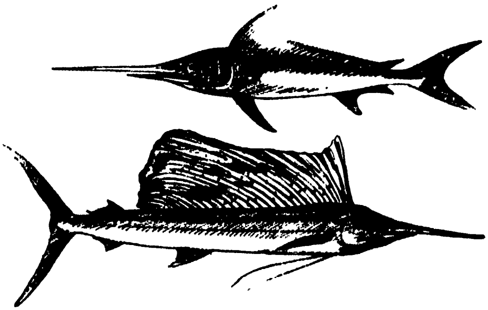
Sword, a weapon of such early and, till comparatively modern times, such general use as to supply a synonym for strife. It consists of two parts: the hilt or handle, and the blade, which may be either curved or straight, with or without a stabbing point, and having one or both its edges sharp. It is not easy clearly to differentiate the dagger from the sword, very short-bladed swords being sometimes exceeded in length by long daggers; but the dagger is the weapon of assassination rather than of a legitimate and open fight. Even the very earliest swords were of metal, the term being hardly applicable to the flattened clubs of wood or stone in use in prehistoric times. The first swords were of copper, their form probably imitated from the Neolithic daggers made of flint or horn. Bronze replaced copper about 2000 B.C., iron gradually coming into use several centuries later. During the bronze period the leaf-shaped blade was common; its length was from 16 to 80 inches. Specimens have been found in Ireland, also at Mycenæ. The Roman sword was straight and double-edged, the blade some 8 feet long; the Greeks, till about 400 B.C., employed a shorter and lighter weapon. The iron swords of the vikings were long, straight, broad-bladed, and of heavy weight, with hilts often richly decorated. Very little science was at first employed in the use of the sword, the overhand stab being common even with those of considerable length. Attack was long the only end in view, simultaneous defence by skilful use of the blade being a modern innovation. Cutting and hacking with the blade-wedges are more simple, and consequently more general, than thrusting with the point; it was by attention to this latter method that the Roman invaders of Britain often routed the unsophisticated natives. Some defence against the opponent's weapon was, however, afforded by the cross-guard or *quillon*, which, at first straight, later assumed a form in which the ends curved towards the blade. It may be noted that in the 'unchanging East' the Asiatic never thrusts, but strikes with the curved scimitar, the edge of which is on the convex of the blade. The cutting power of the scimitar, though great, is counterbalanced by its feeble power of defence. Damascus was long famous for superior blades; Khorāsān still produces weapons of fine quality. Toledo blades, with those produced by the Ferrara family of North Italy—Andrea especially (born 1555) —enjoyed a great repute. In later times the sabre, a heavy sword worn by dragoons, was used for both the cut and thrust. From the rapier developed the light, supple duelling-sword, of which the point alone came into play. The cutlass, broad and straight-edged, with a 8-foot blade, was long the weapon of the British seaman, used in boarding ships. The Highland claymore ('great sword'), with a blade some 40 inches long, had usually a globular pommel. The broadsword was a cutting weapon, while of the old two-handed sword some specimens survive. Basket-hilted swords had highly decorated hilts. In late years, in both France and Britain, there have been frequent changes in the shape and general style of army swords; but in the European War these once so familiar weapons played but a small part. Officers led their men 'over the top' revolver in hand; while it was generally found more useful to arm even cavalry with the rifle.—BIBLIOGRAPHY: Sir R. Burton's unfinished *Book of the Sword* (1884); A. Hutton, *Sword and the Centuries* (1901).

Sword-fish, a spiny-finned fish allied to the mackerel and represented by the common sword-fish (*Xiphias gladius*), the single known species constituting a special family (Xiphiidæ). It occurs in the Mediterranean Sea and Atlantic Ocean, but may also be occasionally found round the coasts of Britain. It attains a length of from 12 to 15 or even 20 feet, the elongated upper jaw, or sword, forming three-tenths of its length. Its body is covered with minute scales. Its colour is a bluish-black above, and silvery white on the under parts. The ventral fins are wanting. It is fished for by the Neapolitan and Sicilian fishermen with the harpoon. Its flesh is very palatable and nutritious. It attacks other fishes, and often inflicts fatal wounds with its powerful weapon; and there are frequent instances in which the timbers of ships have been found to be perforated through and through by the sword-like jaw, which has been left sticking in the wood.



Sword-fishes

Common Sword-fish (*Xiphias gladius*) above. Below, a Sail-fish (*Histiophorus gladius*)

Syb'aris, an ancient Greek city of Lower Italy, on the Gulf of Tarentum, founded by Achæans and Trœzenians about 720 B.C. It rapidly rose to an extraordinary degree of prosperity, and the inhabitants were in ancient times proverbial for their luxury and voluptuousness. It was totally destroyed by the Crotonians, who turned the waters of the River Crathis against it (510 B.C.). In 1879 and 1887 excavations were undertaken by the Italian Government, and two necropolises were found.

Sybel (zē'bl), **Heinrich von**, German historian, born 1817, died 1895. He studied at Berlin under Ranke, and became successively professor of history at Bonn, Marburg, Munich, and Bonn again. In 1875 he became director of the Prussian State archives at Berlin, and member of the Academy of Sciences. He is best known in England by his *History of the French Revolution*,

Sycamore, a European species of maple (*Acer pseudoplatănus*), a large and well-known timber tree (called *plane* in Scotland); also, in the western parts of the United States, a name for the occidental plane or buttonwood. See *Maple*; *Plane Tree*.

Sycamore, a tree of the genus Ficus, the *F. Sycomŏrus*, or sycamore of Scripture, a kind of fig tree. It is very common in Palestine, Arabia, and Egypt, growing thick and to a great height, and, though the grain is coarse, much used in building, and very durable. Its wide-spreading branches afford a grateful shade in those hot climates, and its fruit, which is produced in clusters upon the trunk and the old limbs, is sweet and delicate. The name was at one time frequently written *sycomore*.

Sycosis is a chronic pustular eruption affecting the follicles of the hairs of the beard and moustache. The disease occurs in adult males, most usually among those who are shaved by barbers. Once the disease is established it is very resistant to treatment, and may persist for years.

Sydenham, Thomas, English physician, born 1624, died 1689. He took the degree of Bachelor of Medicine at Oxford in 1648, commenced practice as a physician at Westminster, and applied himself with unusual keenness to observation of the phenomena of disease. Febrile disorders and the gout attracted his especial notice. The Sydenham Society, which owes its name to him, has published an English translation of his works, which were all written in Latin.

Sydney, the capital of New South Wales and the parent city of Australia, is picturesquely situated on the southern shore of Port Jackson, the shore-line being deeply indented by capacious bays or inlets which form harbours in themselves, and are lined with wharves, quays, and warehouses. Some of the older streets are narrow and crooked, bearing a striking resemblance to those of an English town; but the more modern streets, such as George Street, Pitt Street, Market Street, King Street, and Hunter Street, rank high in order of architectural merit. The tramway system is extended to all parts of the suburbs, and water communication between the city and its transmarine suburbs, Balmain, North Sydney, Greenwich, &c., is maintained by steam-ferries. Among the most important public buildings are: the Government offices; the town hall, with a tower 156 feet high, and a great hall with a huge organ; state Governor's house; the university, a Gothic building with a frontage of nearly 400 feet, situated in a fine park; St. Andrew's (Episcopal) Cathedral; St. Mary's (Roman Catholic) Cathedral. The Botanical Gardens are the finest in the colonies (38 acres). Moore Park, 600 acres; the Centennial Park, designed to commemorate the colony's centenary (1888), 768 acres; and the race-course, 202 acres, are other open spaces. The entrance from the Pacific Ocean to Port Jackson, about 4 miles north-east of Sydney, is 1 mile in width, and is strongly fortified; the bay itself is about 10 miles in length and 3 miles in average breadth; it is well sheltered, and has a depth of water sufficient to float the largest vessels. Besides wharves and quays there are dry-docks and other accommodation for shipping, and the trade of the port is very large. The principal exports are wool, tallow, hides, preserved meat, tin, copper, &c.; the imports, grain, tea, coffee, sugar, wine and spirits, ironware and machinery, cotton and woollen goods, wearing apparel, furniture, &c. Sydney was founded in 1788, and was named in honour of Viscount Sydney, the Colonial Secretary. It was incorporated in 1842. The discovery of gold in the colony (1851) gave an immense impetus to its progress. Pop. (1921), 897,650.

Sydney, a city of Nova Scotia, Canada, in Cape Breton county, on Sydney Harbour, the terminus of the eastern division of the Canadian National and of the Sydney and Louisburg Railways, and served coastwise by steamers. It is a bunkering port for many ocean lines, and a great transport centre, with large iron and steel plant employing 4500 men, and as the centre of a great coal-field it has other considerable manufacturing industries. Pop. 22,580.

Sydney Mines, a town of Nova Scotia, Canada, in Cape Breton county, on Sydney Harbour; served by the National and Coal Company's Railways. Over 4800 men are employed in the local collieries and brick-yards, the coal output being roughly 900,000 tons per annum. The Sydney coal-field lies along the seaboard, and embraces 1125 sq. miles. The coal is bituminous, and resembles that of Northern England. Pop. 8400.

Sy'enite, a rock composed of hornblende and orthoclase felspar with occasionally a little quartz. It was named from Aswan, in Upper Egypt, the ancient Syene; but the rock of Aswan is a true granite with abundant quartz. Syenite is a comparatively rare rock, resembling granite. Biotite or even pyroxene occasionally takes the place of hornblende, and the syenites of Southern Norway are rich in nepheline (elæolite). Granite which contains hornblende is called *syenitic granite*, and fine-grained syenite, containing large crystals of felspar, is called *syenite-porphyry*.

Syke, a market town of Hanover, Prussia, the junction for Hoya on the Münster-Bremen (via Osnabruck) line of the State railways.[1] Pop. 2000. Hoya lies on the Weser, and is a junction for Eystrup and Bucken. Pop. 2500.

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[1] See *Systems, Railway* (Paragraphs 8 and 13).

Syl'labus Errorum, a document issued by Pope Pius IX, 8th Dec., 1864, which condemned eighty current doctrines of the age as heresies. The syllabus reasserts all the claims of the mediæval papacy. It provoked conflicts between the Papal and the civil power in Prussia, Austria, and Brazil.

Syllogism and Fallacies. *Syllogism*, in logic (Gr. *syn*, together, and *logos*, thought), the joining together in thought of two propositions. It is defined as 'the act of thought by which from two given propositions we proceed to a third proposition, the truth of which necessarily follows from the truth of these given propositions'. The two first propositions are called *premises*, and the last the *conclusion*. Thus *Plants have not the power of locomotion*; *An oak is a plant*; therefore *An oak has not the power of locomotion*. These propositions are denominated the *major premise*, *the minor premise*, and the *conclusion*. The three propositions of a syllogism are made up of three ideas or terms, and these terms are called the *major*, the *minor*, and the *middle*. The subject of the conclusion is called the *minor term* (oak); its predicate is the *major term* (the power of locomotion); and the middle term is that which shows the connection between the major and minor term in the conclusion, or it is that with which the major and minor terms are respectively compared (*plants*).

The rules of the syllogism are founded upon the Laws of Thought, namely, (1) The Law of Identity: *Whatever is, is.* (2) The Law of Contradiction: *Nothing can both be and not be.* (3) The Law of the Excluded Middle: *Everything must either be or not be.* These rules, which serve to inform us under what circumstances we can infer one proposition from two other propositions, are eight in number:

1. In a syllogism there must be three, and *only* three, terms.
2. Every syllogism must contain three, and *only* three, propositions.
3. The middle term must be distributed once at least, and must not be ambiguous.
4. Neither the minor term nor the major term must be distributed in the conclusion, if it is not distributed in one of the premises.
5. Nothing can be inferred from negative premises.
6. If one of the premises be negative, the conclusion must be negative; and also, *one* of the premises must be negative, if we are to prove a negative conclusion.
7. No conclusion can be drawn from two particular premises.
8. A conclusion must be particular, if one of the premises be particular.

Syllogisms are usually divided into *categorical*, *hypothetical*, and *disjunctive*. They differ in *figure* and in *mood*. The figure depends on the order of the terms in the premises, whilst the distinction of moods depends on the *quantity* or *quality* of the propositions, which are either universal, particular, affirmative, or negative in all possible combinations. The quantity and quality of propositions in logic are marked by arbitrary symbols, as A, E, I, O. Every assertion may be reduced to one of four forms: the universal affirmative, denoted by A; the universal negative, E; the particular affirmative, I; and the particular negative, O. Examples of these are: (A) *All men are liable to err*; (E) *No man is the exact counterpart of another*; (I) *Some men are wise*; (O) *Some men are not wise.* As each of the three propositions of a syllogism may have any of the four forms A, E, I, O, there are 4^3, or 64 moods, but only 19 of these are valid, the rest failing in some respect to comply with the rules. About six centuries ago, mnemonic hexameter verses were invented to aid in remembering the valid moods. The verses are as follows:

Barbara, *Celarent*, *Darii*, *Ferioque*, prioris;
Cesare, *Camestres*, *Festino*, *Baroko*, secundæ;
Tertia, *Darapti*, *Disamis*, *Datisi*, *Felapton*,
Bokardo, *Ferison*, habet; Quarta insuper addit
Bramantip, *Camenes*, *Dimaris* *Fesapo*, *Fresison*.

Each name contains three vowels, indicating propositions forming a valid mood. Thus, *Camestres* signifies the mood having *A* for the major premise, *E* for the minor premise, and *E* for the conclusion.

Fallacies.—A fallacy is the incorrect performance of the process of reasoning, leading to a wrong conclusion. It is thus a violation of a logical law. It is usual to classify fallacies into two groups: (1) *logical fallacies*, occurring in the mere form of the statement, and for the discovery of which no knowledge of the subject-matter is necessary; (2) *material fallacies*, concerned with the subject-matter.

Logical fallacies violate the syllogistic rules. Examples of logical fallacies are: (1) The *Quaternio Terminorum*, or fallacy of four terms, violating the rule that a syllogism should have three, and only three, terms. (2) The fallacy of the *undistributed middle*, violating the syllogistic law that the middle term should be distributed once at least. (3) The fallacy of *illicit process*, violating the rule that no term must be distributed in the conclusion which was not distributed in one of the premises. (4) The fallacy of *negative premises*, violating the law that at least one of the premises must be affirmative. To the logical fallacies also belong the following: *equivocation*, *amphibology* (an ambiguous grammatical structure producing misconception), *composition*, *division*, *accent*, and *figure of speech*.

Among material fallacies the most important are: the *ignoratio elenchi*, or *irrelevant conclusion* (the fallacy of irrelevant reasoning, and arguing to the wrong point, the argument, sound in itself, being assumed to establish a conclusion which is not that actually proved); the *petitio principii*, or begging the question, a fallacy which consists in taking the conclusion itself as one of the premises; and the *fallacy of many questions*, which combines two or three questions into one in such a manner that no true answer, either *yes* or *no*, can be given.—BIBLIOGRAPHY: A. Sidgwick, *Fallacies*; R. Adamson, *Short History of Logic*.

Sylphs, the elemental spirits of the air in the system of Paracelsus. The sylphs, like the other elemental spirits, form the link between immaterial and material beings. They have many human characteristics, are male and female, and are mortal, but have no soul, and consequently suffer annihilation after death.

Sylt, an island in the North Sea, off the coast of Schleswig-Holstein, to which province of Prussia it belongs; area, 40 sq. miles. It consists largely of sand-dune country and marsh land. The inhabitants are Frisians and (in the north) Danes, and are largely engaged in fishing. The island is also a sea-bathing centre. Pop. 5000.

Syl'vester I, Bishop of Rome (314–335), was represented at the Council of Nice, and is said to have held a council at Rome to condemn the errors of Arius and others. The story of his having baptized Constantine and received Rome and its temporalities as a donation is pure fiction. He is honoured as a saint.

Sylvester II, Pope, was born of an obscure family in Auvergne, named Gerbert, and at an early age entered the monastery of St. Gerard, in Aurillac. He travelled into Spain to hear the Arabian doctors, and became so distinguished that he was appointed by Hugh Capet preceptor to his son Robert. Otho III, emperor, who had also been his pupil, conferred upon him the archbishopric of Ravenna in 998; and on the death of Gregory V, in 999, procured his election to the papacy. He maintained the power of the Church with a high hand, was a great promoter of learning, and composed a number of works, particularly on arithmetic and geometry. He died in 1003. Among the vulgar he had the reputation of being a magician.

Sylvester, James Joseph, English mathematician, was born in London of Jewish parents in 1814, and died in 1897. He was second wrangler in the mathematical tripos of 1837, and in the course of his career held many professorships in England and the United States, finally succeeding Henry Smith, in 1883, as Savilian professor of geometry at Oxford. He ranks hardly behind Cayley among British pure mathematicians of the Victorian period. His researches related chiefly to finite, as contrasted with infinitesimal analysis, and he made brilliant and far-reaching discoveries in such theories as invariants and the partition of numbers. The Royal Society, of which he had been a Fellow from 1839, awarded him the Royal medal in 1861, and the Copley medal in 1880.

Sylvester, Joshua, English poet, born in 1563, was a member of the company of merchant adventurers at Stade, Holland. He is known chiefly as the translator into English of the *Divine Weeks and Works* of the French Huguenot poet Du Bartas, a translation to which Milton owed something when writing *Paradise Lost*. Sylvester died at Middelburg, Holland, in 1618.

Sylvia, a genus of perching birds, type of the sub-family Sylviinæ, or warblers, of the thrush family (Turdidæ). Common British examples are: whitethroat (*S. cinerea*), blackcap (*S. atricapilla*), and garden warbler (*S. hortensis*).

Sylviculture, or **Silviculture**, literally the culture of woods, deals with the growing and tending of forests until the products are ready for utilization. Forests are mainly grown for timber, but where monetary returns are of small importance other considerations, such as natural beauty, influence on climate, shelter, and the like, play an important part. Climatology includes the atmosphere, climate, and soil of an area. Most trees thrive best in a moist atmosphere, provided the air is not stagnant. The demand on light varies considerably. There are the light-demanders (e.g. oak and Scots pine), insisting on plenty of light, and the shade-bearers (e.g. beech and spruce), that will flourish under varying degrees of shade. This question of light and shade is of very great importance in practical sylviculture. All trees like a fresh soil, where the natural drainage is good. Some species, such as alder and willow, do well in moist situations, while most of the conifers prefer drier ground. Wind is a very powerful factor in the successful growth of trees. Species with deep tap-roots (e.g. oak and larch) suffer little from wind, while shallow-rooted trees (e.g. spruces) may be easily uprooted. Care must also be taken when felling an area not to cut the trees in the direction of the prevailing wind. To avoid giving the wind an inlet, begin operations at the other side of the wood.

Woods are either *pure*, i.e. of one species, or *mixed*, where more than one species is grown. Some species (e.g. beech, spruce, Douglas fir, &c.) can thrive in pure woods owing to their shade-bearing qualities. Where woods are to be mixed, the best method in practice is that of growing the different trees in larger or smaller groups according as the soil suits them. The first operation in planting is to fence against ground game. Draining may be necessary, and the surface vegetation, if of a coarse nature, should be cut or burnt. Woods may be established either *artificially* by sowing and planting, or naturally by *natural regeneration*. The commonest method is by planting, and the plants must be strong, not too old, and with plenty of fibrous roots. Trees may be planted at any time from October to April, provided the weather conditions are suitable; and the young plants, if coming from a distance, should be carefully packed. There are two main methods of planting: (1) *notching*, or placing the plants under raised pieces of turf; and (2) putting the young trees in small pits, the latter being a more expensive but a better system. Natural regeneration of woods is their establishment by the fall of seed from adjacent mature woods, and though such a method may take several years, the resulting timber is often the finest. During the early life of a wood, gaps caused by failures have to be filled up, and the young plantations must be kept clean. Proper thinning of young woods is an essential operation of great difficulty. Thinnings should be light and frequent rather than seldom and heavy, and towards the end of a wood's rotation thinnings may be heavier, so as to allow the best trees that remain full scope for development. Rotations differ for the various species, and may vary from sixty to ninety years in the case of conifers, to nearly two hundred years for oak. No hard or fast rules can be laid down, however, as the commercial rotation will depend much on the natural factors and the market conditions. The trained forester knows from experience when a forest is ripe for the axe, and realizes that delay in its utilization may mean deterioration of the crop, and economic loss.

Sylvine, mineral potassium chloride, crystallizing like rock-salt in the cubic system, and occurring in beds associated with it. The mixed material is sold as an agricultural fertilizer under the trade name of *sylvinite*, which contains about 25 per cent of potassium chloride. Sylvinite is the chief product of the potash-salt mines in Alsace. Beds of pure sylvine are unknown on a commercial scale.

Symbio'sis, the intimate organic association of two kinds of organisms for mutual benefit. A lichen consists of an alga connected with a fungus; and certain nitrogen-fixing bacteria inhabit nodules on the roots of leguminous plants.

Symbol, a sign by which one knows or infers a thing; an *emblem*. It is generally a definite visible figure intended to represent or stand for something else, as in the case of the common *astronomical symbols*, which are signs conveniently representing astronomical objects, phases of the moon, &c., and astronomical terms. Some of these symbols are so ancient that we can find no satisfactory account of their origin. The symbols for the chief heavenly bodies are as follows: Sun ☉, Mercury ☿, Venus ♀, Earth ♁ and ⊕, Moon ☾, Mars ♂, Jupiter ♃, Saturn ♄, Uranus ♅, Neptune ♆, Comet ☄, Star ✱. The asteroids are represented by a circle with a number, thus, (64). *Lunar phases*: ● Moon in conjunction, or *new*; ☽ Moon in eastern quadrature, or *first quarter*; ○ Moon in opposition, or *full*; ☾ Moon in western quadrature, or *last quarter*. See *Ecliptic*.—*Chemical symbols* are merely the first letters of the names of the chemical elements; or, when the names of two or more elements begin with the same letter, two letters are used as the symbol, one of which is always the first letter of the name of the element. Generally speaking, the letters comprising the symbol are taken from the English name of the element; but in some instances, especially in the cases of metals which have been long known, the symbols are derived from the Latin names, as Fe (Lat. *ferrum*) for iron. See *Chemistry*.—*Mathematical symbols* are letters or characters used to denote numbers, functions, operations, and relations. Sometimes a letter is used for a definite number, as e, or π; more usually, however, the use of a letter for a number indicates that the number is not restricted to have one special value. On the other hand, any one letter which occurs in an investigation must represent the same number throughout. Similarly, when a letter is used as a symbol for a *function*, it may stand either for one special function, or for any function at all. The symbols Γ, Π, J, for example, are invariably understood to stand for the gamma, pi, and first Bessel Function respectively. Symbols other than letters, such as $+$, $-$, $\times$, $\div$, $\surd$, $\therefore$, $=$, $>$, $<$, are also in general use as a kind of shorthand for common words or phrases.

Symbolism, the representation of a thing, person, or idea by a conventional sign which —invested with an inner meaning—recalls the idea, person, or thing in consequence of a process of analogy. The use of objects as sensuous emblems of spiritual acts has been widespread in religion, pagan as well as Christian. The Old Testament is full of symbolism, and the early Christians, in consequence perhaps of persecutions, and anxiety not to attract attention, introduced symbols into their religion. Thus Christ is represented as the lamb or by the letters alpha and omega. Symbolism is also important in primitive and Christian art.—

Cf. R. P. Knight, *The Symbolical Language of Ancient Art and Mythology.*

Symbolists, the name applied to a school of writers which sprang up in France in the latter half of the nineteenth century. The Symbolists used in poetry the details of the phenomenal world exclusively as symbols of that inner and spiritual reality which it was their aim to project in art. Concerned with general truth instead of actualities, they chose dreams and visions as their subjects, and suggested instead of naming. The Symbolist movement, which profoundly influenced French literature, was a reaction against the realism of the Parnassians (q.v.). The most noteworthy members of the Symbolist school were Paul Verlaine, Stéphane Mallarmé, Henri de Régnier, and the Belgian poet Maeterlinck.—Cf. A. Symons, *The Symbolist Movement in Literature.*

Sym'machus, Quintus Aurelius, Roman writer and orator, who flourished about A.D. 340–402, held important public offices under Theodosius the Great, and was a zealous champion of the pagan religion. We possess ten books of letters by him, which are of importance for the history of the time, and the fragments of nine orations.

Sy'monds, John Addington, English man of letters, born 1840, died 1893. He was educated at Harrow and at Balliol College, Oxford. His great work is the *Renaissance in Italy* (1875–86). Among his other works are: *Study of Dante*; *Studies of the Greek Poets*; *Sketches in Italy and Greece*; *Sketches and Studies in Italy*; translations of the *Sonnets* of Michelangelo and Campanella; *Animi Figura,* a collection of sonnets; *Vagabunduli Libellus*; *Wine, Women, and Song*; *Essays*; *Life of Michelangelo.*

Sympetalæ, the gamopetalous section of dicotyledonous plants in Engler's classification, corresponding to the Corollifloræ of Bentham and Hooker.

Sym'phony. A symphony is the most important form of instrumental composition, and might be described as a sonata for full orchestra, the symphony being in most cases of greater dimensions and altogether broader in its scope, in consonance with the larger musical means employed. As an instrumental form it dates from the latter half of the eighteenth century, the first representative examples coming from the pen of Haydn, who wrote in all a hundred and twenty-five symphonies. Mozart wrote forty-one symphonies, of which the *Jupiter* and those perfect examples in E flat and in G minor are the most famous. With the development of the art of composition, the labour involved in writing works of large dimensions became steadily more exacting, and this accounts for the fact that Beethoven wrote only nine symphonies. Though numerically this was a small output, the works themselves are of outstanding importance, and mark a very great advance both as regards their form and their range of expression. While all of them are in the standard orchestral repertoire, the *Eroica* (No. 3); the fifth, in C minor; the *Pastoral* (No. 6); the seventh; and the ninth are the most frequently played. The *C minor* may fairly be regarded as the most universally popular symphony ever written. The ninth symphony is the longest and perhaps the greatest of all, embodying for all true Beethoven lovers the finest expression of his 'third period'.

Another notable writer of symphonies was Schubert, whose *Unfinished Symphony* takes rank in popular favour with the fifth of Beethoven, and whose great symphony in C is almost equally popular. Schumann wrote four fine examples. Brahms also wrote four symphonies of great power and beauty, which are regarded as in the line of direct descent from those of Beethoven. The Tchaikovsky symphonies are less truly symphonic in their texture than the classical examples, but make a quick and wide appeal by virtue of their melodiousness, their almost sensational dramatic qualities, and their gorgeously coloured orchestration.

A symphony generally consists of four movements, of which the first is almost invariably in sonata-form (q.v.), and the second of a slower and song-like character. The third movement was always a minuet and trio in the earlier examples, but later a scherzo (q.v.), while the last movement is generally fashioned on the plan of the first movement, though more freedom of form and of structure is frequently found. Thus the last movement of Brahms' fourth symphony is, broadly speaking, a series of variations on a ground bass. An exceptional form of last movement is found in Tchaikovsky's *Symphonie Pathétique,* which closes with a poignantly pessimistic lament. A shorter or longer introduction frequently precedes some of the movements, especially the first and last; and in some more recent examples of the symphony a 'motto' theme appears in the first movement, and reappears in some or all of the remaining movements.

A *symphonic poem* may be defined as a symphony in one continuous movement, and free in form. Both symphonies and symphonic poems should be consistently built up by the development and interweaving of a limited number of principal themes; and the power to distinguish himself in writing in either form proves a composer to be an inspired thinker and an expert craftsman. Symphonies are rarely written nowadays. The latest example is the *Colour Symphony* of Arthur Bliss (1922).

Sympiesom′eter, a kind of barometer in which the weight of the air is indicated by the compression of gas in a tube, the lower part of the tube being filled with some oily fluid and the gas occupying the upper portion. By an auxiliary contrivance, allowance can be made for the temperature at the time of observation. The instrument is sensitive, but not very accurate. It was at one time a good deal used on board ship, but has been superseded by the aneroid barometer.

Sympodium, in botany, a false main axis, built up from the basal parts of branches of successively higher order, as a twig of the lime, or the rhizome of Iris. See *Branching*.

Synagogue (from Gr. *synagogē*, an assembly), the recognized place of public worship among the Jews. Its origin, it is supposed, belongs most probably to the date of the Babylonian captivity in the abeyance of temple worship. The synagogues were so constructed that the worshippers, as they entered and as they prayed, looked towards Jerusalem. At the extreme east end was the holy ark, containing copies of the *Pentateuch*; in front of this was the raised platform for the reader or preacher. The men sat on one side of the synagogue and the women on the other, a partition 5 or 6 feet high dividing them. The chief seats, after which the scribes and Pharisees strove, were situated near the east end. The constitution of the synagogue was congregational, not priestly, and the office-bearers were not hereditary, but were chosen by the congregation. A college of elders, presided over by one who was the ruler of the synagogue, managed the affairs of the synagogue, and possessed the power of excommunication. The officiating minister was the chief reader of the prayers, the law, the prophets, &c. The modern synagogue differs little from the ancient. Instead of elders there is a committee of management; and the women are now provided with
ats in a low latticed gallery.—The *Great*
agogue was an assembly or council of 120
bers said to have been founded and pre-
over by Ezra after the return from the
v. Their duties are supposed to have
remodelling of the religious life of the
the collecting and redacting of the
of former times.—Bibliography:
ish Encyclopædia; J. Abrahams,
he Middle Ages.

Motors. Alternating-current
le into two classifications,
nchronous, according to
Asynchronous motors,
duction motor (q.v.) is
a speed slightly lower
o the periodicity of
ly. On the other hand, those that work in step or phase with the supply current and have no slip are referred to as synchronous motors. There are many distinctive types of such motors, but the main supply is usually applied to the stationary windings, instead of to the rotating part as in the common direct-current motor. By that arrangement good insulation is possible for the conductors carrying the high-pressure supply, and either no brush or collector gear is needed for the rotor, or whatever is necessary has only to deal with low-pressure currents.

The synchronous motor is simply an alternating-current generator reversed in its operation. The field coils are excited from a direct-current supply, or by rectified currents taken from the main alternating supply. When the rotating system is brought up to the speed corresponding to the periodicity of the supply, it continues to run under that condition until the motor is shut down. The magnetic field set up in the primary or stationary coils is of a rotary character, and the conductors of the rotor create magnetic fields which ‘lock’ with that of the stator coils, and thus the speed remains constant. Drastic actions, such as the very sudden imposition of heavy loads, may pull the rotor out of synchronism, in which case it will slow down and stop, and the restarting must be done while the motor is only lightly loaded. The application of a series of short-circuited coils or *amortisseur* windings to the rotor prevents hunting about the synchronous speed, reduces the possibilities of shut-downs, and also serves to permit the starting of the machine as an induction motor. Synchronous motors are very useful at points distant from the supply-station, as by over-exciting them the current of the system may be given a lead over the pressure, and thus correct the lagging actions caused by the use of induction motors or other appliances which have the same effect.

There are alternating-current motors of types corresponding with the series and shunt motors used on a direct-current supply. Any continuous-current series motor may be connected to a single-phase alternating-current supply system, and will run on it. This useful action, due to the simultaneous reversal of the armature and field currents, makes it possible to construct motors which are universal machines. The repulsion motor corresponding to the shunt type of continuous-current working has no connection between the armature and field. The stationary windings induce currents in the rotor which act with the magnetic field caused by the fixed armature coils to set up a driving torque. On the rotor there is usually a commutator, with the brushes set opposite to each other and permanently short-circuited. At the synchronous speed the motor runs practically sparkless, but at higher or lower values, which are possible, the commutation is not always satisfactory. Better running conditions are obtainable with motors of the two main types combined than with the simple repulsion motor. In fact, the best characteristics of both types of motor are then obtained.

Synchronous motors of large size are used in motor generators for the transformation of high-tension alternating currents into low-pressure direct currents for a supply system. In that case the machine can be brought up to synchronous speed by running what is normally the generator as a motor off the direct-current supply, and, when the correct speed is reached, connecting up the alternating-current side to the input system. This can only be done safely when the machine is running in proper phase relationship with the alternating-current supply, and instruments known as synchronizers are used for the purpose. The magnitude of the difference in phase between the supply and the machine is indicated by the intensity of illumination of an incandescent lamp.

Syncopation. When modern music began at the end of the sixteenth century to establish itself upon the basis of folk-music, it received from this popular source two qualities in particular, harmony and accent. The latter was derived more directly from the folk-dances, and the regular recurrence of accent, which is a necessary feature of all dance music, was largely retained in the early works of the new instrumental composers. With the development of the craft of composition came the wish and the power to vary this regularity of the accents, and syncopation was introduced. Syncopation is a disturbing of the regular metrical accent by singing or playing an accented note before it is due, thus anticipating the accent by half a beat or more. This was not a new feature in music, as a study of folk-tunes will quickly demonstrate, but its use as a conscious device in composition only came gradually into favour. As a musical effect syncopation is very enjoyable when kept within bounds, but the excessive use of it, as exemplified by 'rag' time, quickly destroys its charm, which is always in inverse proportion to its quantity. It is further important that the music should be so contrived as to introduce the element of syncopation without destroying in the mind of the listeners the sense of the regular accents from which the syncopation is a departure. Schumann, who habitually made very free use of the device in his compositions, was not always careful in this respect. An outstanding illustration is furnished by the last movement of his well-known piano concerto, where the second main theme is presented as a regularly syncopated form of triple time, but sounds to any listener who does not know the score as an ordinary example of duple time. Schumann's partiality for syncopation was satirized by an adverse French critic, who, when the great composer died, suggested that perhaps the cause of death was syncope.

Syncope is the name given to a condition produced by a temporary suspension of respiration and of the circulation. On account of the inadequate supply of blood to the brain it results in faintness, or even a complete loss of consciousness, so that the patient collapses. It may occur in hæmorrhage or some forms of heart disease, and is liable to arise in all diseases or conditions which cause a very low blood-pressure. It is also seen as a result of mental shock or emotional disturbance, while in some people, with unstable vasomotor systems, a tendency to faint is always present.

Syndic, an officer entrusted with the affairs of a city or other community; also, a person appointed to act in some particular affair in which he has a common interest with his constituents, as when he is one among several creditors of the same debtor. The name has been given in different countries to various municipal officers. The mayors of towns in Italy are called syndics. In the University of Cambridge the term is applied to members of special committees appointed for specific duties.

Syndicalism (Fr. *syndicat*, a trade union), a policy involving ownership of the means of production in each trade by a union of the workers in that trade. Since the French Syndicalists adopted (about 1902) a policy of *direct* as opposed to *parliamentary* action, with the object of forcing the Government to accede to their wishes, the meaning of the word has become somewhat confused, and it is often applied to the advocates of political strikes rather than to those who wish to introduce a particular method of conducting industry. For a time the term *Syndicalist* supplanted *Socialist* as an indiscriminate term of abuse for people who were thought to be politically dangerous. Now it has given place in its turn to the word *Bolshevist*, which has the great advantage of having no proper meaning at all. Syndicalism, in its original sense, has a considerable following among the workers of France, where State socialism has never made much headway. It found a philosopher in M. Georges Sorel, whose *Réflexions sur la violence* is devoted to the idealization of 'proletarian violence' as a thing good in itself. The syndicalism of M. Sorel has probably more affinity, however, to the anarchism of Nietzsche and the *élan vital* of Bergson than to any conscious aims of French trade unionists. The word first came into general use in Great Britain about 1912, when the coal strike was widely attributed to political agitators, and the followers of Tom Mann formed the Industrial Syndicalist Education League. Since that time the more moderate proposals of the *Guild Socialists* (see *Socialism*) have largely taken the place of syndicalism as a method of controlling industry advocated by intellectual leaders of the British Labour movement, while the more extreme advocates of social revolution have been diverted by events in Russia from French syndicalism to Marxian socialism. To advocate that the means of production in each trade should be owned by a union of the workers in that trade is, to some extent, to return to the attitude of the early Socialists, such as Robert Owen and William Morris. Morris desired that everything made should be " a joy to the maker and the user ". He thought less of the material wealth of the worker than of his spiritual welfare. In this the Syndicalist is with him. He demands that the worker shall control the conditions under which he works, and shall take a conscious part in production, so that he may feel the satisfaction of creative work, and become something more than a mere cog in the machine. That there is something in this idea, and that the more thoughtful working men and women care for ' status ' as well as for ' wages ', has been recognized in various ways during the last few years, and many devices are being tried for associating the worker with the direction of industry. Whitley Councils, i.e. joint industrial councils representing employers and employees (as advocated in the *Report* of the Whitley Committee to the Ministry of Reconstruction), have been set up in many trades; while a definite experiment in syndicalism is being made by the Building Guilds of London and Manchester.

The complete Syndicalist scheme for the control of industry presents many difficulties, of which the most fundamental is the danger that the interests of the community as a whole, and the consumer in particular, might be sacrificed in a struggle between powerfully organized self-governing industries. The methods attributed to the Syndicalists do not commend themselves to law-abiding citizens. The general strike might be a powerful weapon for destruction, but it is ill-adapted to the purpose of introducing a better industrial order. In Great Britain some anxiety was felt during the years immediately after the European War lest the Triple Industrial Alliance between the coal-miners, railwaymen, and transport workers should facilitate a strike on a large enough scale to paralyse economic life. The failure of the other members of the Alliance to support the miners in the coal dispute of 1921, however, led to the break up of the Alliance; and, for the present at any rate, the danger of anything approaching a general strike appears to be remote. There still remains, however, a danger of a different order associated with syndicalism. though it has little connection with the original meaning of the term. The large scale on which the workers in some of the most vital national services are organized has many advantages from the standpoint of industrial efficiency, but it inevitably makes the nation as a whole a party to any dispute which may arise over the conditions of employment. A stoppage of the coal-mines or the railways instantly paralyses the country, and the Government cannot therefore afford to remain an impartial spectator of such a conflict. The result is that the Government is practically bound to make itself responsible for the terms arranged between employers and employees in these great services; and, consequently, a dispute becomes automatically an attempt to bring pressure to bear upon the Government by inflicting inconvenience and suffering upon the community as a whole.

Synod (Gr. *synodos*, assembly), an ecclesiastical assembly convened to consult on Church affairs. A synod may be diocesan, composed of a bishop and the clergy of his diocese; or provincial, of an archbishop and the bishops and clergy of his province; or national, of the whole clergy of a state under a Papal legate. The convocations of the English clergy are provincial synods (see *Convocation*). Synods in the Presbyterian Church are courts of review standing between the presbyteries and the General Assembly, and embracing a certain number of associated presbyteries, the clergy and elders of which constitute the respective synods. See *Assembly, General*; *Presbyterianism.*

Synodical Period, in astronomy, the period between two successive conjunctions or oppositions of two heavenly bodies. A synodical month is a lunation, being the period from one full moon to the next full moon, or from new moon to next new moon. Owing to the sun's apparent eastward motion in the ecliptic, this is over two days longer than the sidereal month, or moon's revolution period, and its average length is 29 days, 12 hours, 44 minutes, 2·37 seconds.

Synovial Membrane, the membrane lining the various joints or articulations of the higher animals, which secretes a peculiar fluid—the *synovial fluid*—for the due lubrication of the joint. The structure of the synovial membrane resembles that of the serous membranes. Its secretion is a thick viscid fluid somewhat resembling white of egg. *Synovitis*, inflammation of the membrane, with increased secretion of fluid, is common. See *White-swelling*.

Syntax, that part of grammar which treats of the manner of connecting words into regular sentences, or constructing sentences by the due arrangement of words or members in their mutual relations according to established usage. In every language there is some fundamental principle which pervades and regulates its whole construction, although it may occasionally admit of particular variations. In some languages the principle of juxtaposition prevails, and little diversity of arrangement is possible, as is the case in English, in which inflections are so few. The relations of the subject, the action, and the object are indicated by their respective positions. In other languages—inflected languages like Latin or Greek—these relations are indicated by the changes in the forms of the words, and the modes of arrangement are various. Still, in the structure and disposition of sentences and parts of sentences the logical relations of the thoughts must regulate the construction, even where it appears to be most arbitrary.

Synthetic Chemicals, a term used for chemicals prepared from the elements, to distinguish them from those prepared from natural sources. Originally most of the chemical substances known were of plant or animal origin. Thus benzoic acid was obtained from gum benzoin, salicylic acid from oil of wintergreen, alizarin from the madder root, and indigo from the indigo plant. As chemical science advanced, the structure of compounds came to be known, and knowledge of structure in many instances suggested methods of synthesis. The introduction of synthetic chemicals has revolutionized industrial chemistry, as the manufacturer is no longer dependent on the natural source for his supplies. For example, a few years ago it was observed that the Chile saltpetre beds were rapidly becoming exhausted, a serious matter for chemists, as these beds formed the natural source of nitric acid and the nitrates. Now, however, nitric acid and the nitrates can be prepared synthetically from the nitrogen of the air by Birkeland and Eyde's method, and large factories have been erected in Norway and other countries for the production of synthetic nitrates and nitric acid. Ammonia can also be synthesized from its elements nitrogen and hydrogen by the method introduced by Haber, and ammonia and ammonium salts are thus prepared in considerable quantity synthetically.

Dyes were all obtained at one time from plants and plant juices. The best-known of these natural dyes are alizarin, obtained from the madder root; and indigo, from the indigo plant. These two dyes have been successfully synthesized, and now alizarin is obtained from anthracene, and synthetic indigo has superseded natural indigo. The modern dyes, e.g. *aso dyes*, *sulphur dyes*, *phthalein dyes*, and *aniline dyes*, are all synthetic products. *Drugs* were formerly always obtained from vegetable and animal sources, but now many are prepared synthetically, e.g. phenacetin, aspirin, salol, adrenaline, paraldehyde, and novocaine. Many antiseptics and preservatives, such as the phenols and salicylic acid, are synthetic chemicals; and rubber, originally obtained exclusively from the rubber plant, can now be synthesized from the substance *isoprene*. *Sugars* have been synthesized from carbon dioxide and water, and sugar substitutes, such as *saccharine*, are also built up artificially. Many *perfumes* once obtained from flowers are now prepared chemically, e.g. heliotrope perfume from piperonal, and violet perfume from ionone. Flavouring *essences*, such as pear oil and pineapple oil, are obtained from synthetic esters.

Syph'ilis, a disease usually communicated by impure sexual connection. It is a contagious and hereditary venereal disease, characterized in its primary or local stage by chancres or ulcers on the genitals, succeeded by inguinal buboes. The indications of a secondary or constitutional affection are ulcers in the throat, copper-coloured eruptions on the skin, pains in the bones, nerves, &c. The name of this disease is traced to a poem written in Latin hexameters by the Italian Fracastoro, and published in 1530. It is impossible to say when or where the disease originated, but it appears to have occurred in Europe and certain parts of Asia from the earliest times, and has gradually spread over the whole globe. During the latter part of the fifteenth century it assumed an epidemic form, and spread throughout the whole of Europe. Schaudinn and Hoffmann, in 1905, described the parasite, *Spirochæta pallida*, to which the disease is due. Our own day has also seen a vast improvement in the treatment of syphilis in all its forms, due to the introduction of an arsenic-containing drug by Ehrlich. Older remedies have not, however, been superseded.

Syra (ancient Syros), a rocky, barren Greek island of the Cyclades. Syra, or Hermoupolis (pop. 18,000), a seaport, is the capital. Area, 30 sq. miles; pop. 35,000.

Syr'acuse (*Siracusa*), a department of Italy, in the island-province of Sicily. Area, 1488 sq. miles; pop. 500,000.

Syracuse (*Siracusa*), a seaport of Sicily, capital of the department of Syracuse, anciently capital of the island; served by rail from Catania. The ancient city was of a triangular form, 22 miles in circuit, and consisted of four parts surrounded by distinct walls; the modern city is confined to the small island of Ortygia, and is only about 2½ miles in circuit. It has some interesting remains. The cathedral partly consists of an ancient Greek temple (perhaps of Pallas Athene). Syracuse was founded by a colony of Corinthians under Archias (734 B.C.), and, according to Thucydides, possessed a greater population than Athens or any other Grecian city. Among the most famous of its ancient Greek rulers were Gelon, Dionysius the elder and the younger, and Hiero I and II. A besieging Athenian force was annihilated in 414 B.C.; it fell into the hands of the Romans (212 B.C.), and continued in their possession till the downfall of their empire. In A.D. 878 it was destroyed by the Saracens, and the mainland portion of the city has never since been rebuilt. Oranges and lemons, earthenware, and drugs are now exported. Pop. 44,094.

Syracuse, a city of New York, United States, the county seat of Onondaga county; served by the West Shore, New York Central, and Delaware Railways, and by Oswego and Erie Canals. Niagara Falls electric power is used by local factories, which produce clothing, foundry and machine-shop products, typewriters, &c. Settled in 1805, Syracuse became a city in 1847. Pop. (1920), 171,717.

Syr-Darya, or **Jaxartes**, a river of West Turkestan, rising on the 'roof of the world' in the Thian-Shan, and discharging to the Sea of Aral after a course of 1700 miles; drainage area, 325,000 sq. miles.

Syr'ia, a former province of Asiatic Turkey, now an independent state under the mandate of France; area, estimated at about 60,000 sq. miles. There are four governments, viz. Damascus, Aleppo, Alaouite Territory, and the Great Lebanon. The coast has some low sandy tracts, but is in general, though not deeply indented, lofty and precipitous, and the coastal plain rises abruptly to the lofty Lebanon Range. The only good harbours are those of Beyrout and Alexandretta (Scanderoon). In Lebanon the mountains reach a height of about 10,000 feet. Between the two parallel ranges of Lebanon and Anti-Lebanon is the valley of Cœle-Syria, whence the Orontes flows northwards, turning westwards at Antioch, and falling into the sea at the ancient Seleucia. Syria is primarily agricultural. The orchards of Damascus are celebrated, and the olive tree and the vine are found in all parts. Other products include wheat (the chief cereal), sesame (for oil), tobacco (from Latakia, Beyrout, Damascus, and Aleppo), cotton, hemp, and sugar-cane. Minerals may exist in quantity, but the country has yet to be thoroughly prospected. Manufactures are negligible, but flour, oil, soap, wine, and silk thread are capable of development. The inhabitants, roughly estimated at about 3,000,000, are preponderatingly Arab, upholding mainly the Sunnite doctrine of Mahommedanism. Arabic, with local dialectic variations, is the usual language. Aleppo, Damascus, Beyrout (Beirut), Homs, Aintab, Latakia, Antioch, and Tripoli are the chief towns. Syria is served by 620 miles of the Hedjaz Railway, by 190 miles of the Bagdad Railway, and by a line traversing the country from north to south, with feeders to various ports.

Syria at an early period became part of the Assyrian Empire, and afterwards passed to the Persians, the Greeks, and the Romans. It formed part of the Byzantine Empire, but was taken by the Arabs in A.D. 636; by the Seljuk Turks in 1078; by the Crusaders, whose kingdom of Jerusalem lasted till 1293; by the Mamelukes, who united it with Egypt; and by the Ottoman Turks, who added it to their empire in 1517. The most important events in the modern history of Syria are its conquest by Mehemet Ali of Egypt in 1833, and its restoration to Turkey in 1840 by the intervention of the Great Powers; the war between the Druses and Maronites which broke out in 1860, peace being restored in 1861 only by the active efforts of a French force sent out under sanction of Turkey and the western Powers; and the setting up of an independent state under the Treaty of Sèvres (10th Aug., 1920), a mandate being granted to France by the Supreme Council (San Remo, 25th April, 1920).

Syriac Language and Literature. Syriac is the Aramaic dialect of Edessa and Western Mesopotamia, and thus one of the Semitic family of languages. It was a vernacular dialect in Syria during the early centuries of our era, but ceased to be spoken as a living language about the tenth century, being crowded out by that of the Arabian conquerors. A very much corrupted form of it, however, is still spoken by a few scattered tribes, and principally by the Nestorians of Kurdistan and Persia. Syriac literature had its rise in the first century A.D., and its literary seat was Edessa. The oldest work in the language still extant is the incomplete translation of the Bible called the *Peshita.* In addition to the Peshita Version, which was recognized as the authorized version by all the various sects of the Syrian Church, there is one made in the beginning of the seventh century by Paul of Tela, a Monophysite; this is based on the Hexaplar Greek Text, that is, the *Septuagint* with the corrections of Origen, and is of very great value for the criticism of the *Septuagint.* Another version, the Syro-Philoxenian, made by Philoxenus, Bishop of Hierapolis (488–518), is partly in existence. The most learned representative of the old orthodox Syrian Church is undoubtedly Ephraem Syrus, who flourished in the fourth century.—BIBLIOGRAPHY: A. J.

M'Lean, *Grammar of the Dialects of Vernacular Syriac*; W. Wright, *History of Syriac Literature.*

Syringe, an instrument consisting of a cylinder of metal or glass fitted with an air-tight piston, which can be moved backwards and forwards in the cylinder by hand. To use the simplest form of syringe, which has no valves, the piston is driven home in the cylinder, the nozzle inserted in the liquid, and the piston withdrawn. The liquid is thus forced into the cylinder by atmospheric pressure, and can be ejected as required by again pushing home the cylinder. In another form the cylinder and piston are replaced by a length of rubber tubing, fitted with a valve at each end, and widening out into a spherical bulb at the middle. One valve, which opens inwards, is inserted in the liquid, the other valve, which opens outwards, being next the nozzle. By alternate compression and release of the bulb, the liquid is drawn into the tube; when it is sufficiently full, each compression expels liquid by the nozzle, and each release draws in a further supply.

Systems, Railway. It is proposed here to enumerate some of the most important transcontinental lines and steamer connections, as a supplement to the railway data embodied in the geographical and other articles, which should be consulted where references to them are made in the text. Most of the great trunk lines depend for their general direction and their grades upon the topography of the country served.

1. *London-Paris.*—There are four main routes, all of which are operated on the British side by the Southern Railway.

(*a*)	London	Victoria-Newhaven,	56½ miles	Total 253½ miles	Paris (St. Lazare Station): running over the French State Railways. Havre and Dieppe lines join at Rouen (Right Bank Station).
		Newhaven-Dieppe,	74 ,,		
		Dieppe-Rouen,	38 ,,		
		Rouen-Paris,	85 ,,		
(*b*)	London	Waterloo-Southampton,	74 ,,	Total 340 miles	
		Southampton-Havre,	126 ,,		
		Havre-Rouen,	55 ,,		
		Rouen-Paris,	85 ,,		
(*c*)	London	Victoria-Folkestone,	70 ,,	Total 259 miles	Paris (Nord Station): running over French Chemin de Fer du Nord. The Calais-Paris line is via Boulogne.
		Folkestone-Boulogne,	31 ,,		
		Boulogne-Paris,	158 ,,		
(*d*)	London	Victoria-Dover,	77 ,,	Total 287 miles	
		Dover-Calais,	25 ,,		
		Calais-Paris,	185 ,,		

From Paris (Nord) to Paris (P.L.M.) there is a junction line.

2. *P.L.M.* (Paris-Lyons-Mediterranean).—This is a remarkable railway that runs southwards through the heart of France, from Paris to Marseilles, a distance of 536 miles. (*a*) The line runs via Moret, Sens, Joigny, Tonnerre, Dijon (for Belfort, 117 miles, via Dôle and Besançon), Châlon (sur-Saône), Mâcon (for Aix-les-Bains, Modane, the Mont-Cenis Tunnel, Turin), Lyons (for Marseilles, via Grenoble), Valence, Orange, Avignon, Arles. (*b*) From Marseilles the line is continued to Ventimiglia (161 miles), via Toulon, Cannes, Nice, Monte Carlo, Mentone; and from Ventimiglia to Genoa (94 miles), via San Remo and Savona [1] (see *Porto Maurizio*; *Riviera*). (*c*) A second line runs from Paris to Nîmes (299 miles), via Moret, Montargis, Nevers, Moulins, Varennes, St. Germain des Fosses, Gannat, Riom (for Chatel-Guyon) [2], Alais, Nozières. (*d*) There is an extension to Cette (48 miles), for Narbonne and Barcelona [3(*d*)] [3].

3. *France-Spain.*—(*a*) From Paris to Orleans (by Orleans Railway) is 78 miles. (*b*) After Orleans there are two alternative routes; the first of which (western) runs via Blois, Tours (for Angers, Nantes, Le Croisic), Poitiers, Angoulême, and Coutras to Bordeaux, a distance of 217 miles. (*c*) Southwards from Bordeaux the line passes via Lamothe (for Arcachon on the coast, 10 miles), Dax (for Pau, 53 miles), Bayonne, Biarritz, and Hendaye over the Spanish frontier (see *Spain*, section *Communications*) to Irun [4]. (*d*) The eastern line runs from Orleans to Toulouse (367½ miles), via Vierzon, Châteauroux, Argenton, Limoges [5], Brive, Cahors, and Montauban; thence along a section of the Southern Railway, via Castelnaudary and Carcassonne, to Narbonne (93 miles), where the P.L.M. line from Marseilles via Cette [2(*d*)] joins on. Narbonne to Portbou (for Barcelona), via Perpignan and Cerbère, is 66½ miles. Toulouse to Barcelona, via Portbou, is 263 miles. (*e*)

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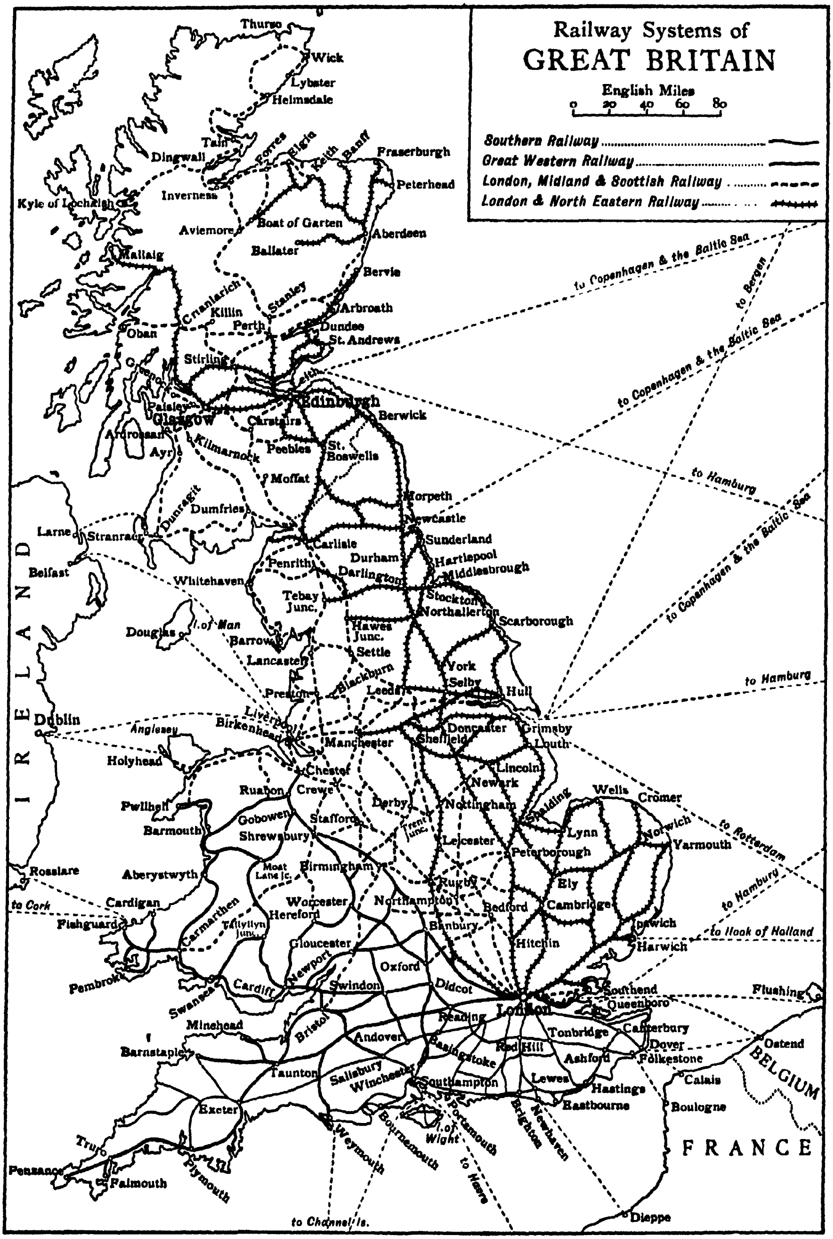
[1] Savona is the terminus of the line to Turin (91 miles), via San Guiseppe and Bra.

[2] A place with iron springs and bathing establishments, in the French department of Puy-de-Dôme (q.v.).

[3] The bracketed figures cross-refer to the initial numbers, and the letters to the alphabetical subdivisions of paragraphs in this article.

[4] From Bayonne to Irun (23 miles) is a French Southern (Midi) Section. The Southern has its head-quarters at Toulouse, which is connected with Bayonne by a line (200 miles) round the base of the Pyrenees, via Tarbes and Pau. Toulouse to Bordeaux by Southern Railway, via Montauban and Agen, is 160 miles. There is through communication with Cette from Bordeaux, via Toulouse, and the line to Narbonne, dealt with in 3(*d*) above. Bordeaux to Cette is 296 miles. Bordeaux to Bayonne by Southern Railway is 123 miles.

[5] Angoulême and Limoges are connected by rail via St. Junien. Clermont-Ferrand to Limoges is 135 miles. Brive is the junction for Toulouse, via Villefranche.


Railway Systems of
GREAT BRITAIN
English Miles
0 20 40 60 80
Southern Railway
Great Western Railway
London, Midland & Scottish Railway
London & North Eastern Railway
Thurso
Wick
Lybster
Helmsdale
Tain
Dingwall
Forres
Elgin
Keith
Banff
Fraserburgh
Peterhead
Inverness
Kyle of Lochalsh
Aviemore
Boat of Garten
Aberdeen
Ballater
Mallaig
Bervie
Crianlarich
Stanley
Arbroath
Killin
Perth
Dundee
Oban
St. Andrews
Stirling
Greenock
Leith
Edinburgh
Paisley
Glasgow
Berwick
Carstairs
Ardrossan
Ayr
Kilmarnock
Peebles
St. Boswells
Moffat
Dunragit
Dumfries
Morpeth
Newcastle
Larne
Stranraer
Carlisle
Sunderland
Durham
Hartlepool
Belfast
Penrith
Middlesbrough
Whitehaven
Darlington
Tebay Junc.
Stockton
Northallerton
Scarborough
Douglas
I. of Man
Hawes Junc.
Barrow
Settle
Lancaster
York
Blackburn
Selby
Preston
Leeds
Hull
Dublin
Liverpool
Anglesey
Birkenhead
Doncaster
Grimsby
Manchester
Sheffield
Louth
Holyhead
Chester
Lincoln
Newark
Ruabon
Crewe
Derby
Nottingham
Wells
Cromer
Pwllheli
Spalding
Gobowen
Stafford
Trent Junc.
Lynn
Norwich
Barmouth
Shrewsbury
Leicester
Yarmouth
Peterborough
Moat Lane Jc.
Birmingham
Rosslare
Aberystwyth
Rugby
Ely
to Cork
Cardigan
Carmarthen
Worcester
Northampton
Bedford
Cambridge
Fishguard
Hereford
Banbury
Ipswich
Tallyllyn Junc.
Gloucester
Hitchin
Harwich
Newport
Oxford
Pembroke
Cardiff
Swindon
Didcot
Southend
Swansea
London
Queenboro
Minehead
Bristol
Reading
Canterbury
Tonbridge
Barnstaple
Andover
Basingstoke
Red Hill
Dover
Ashford
Folkestone
Taunton
Salisbury
Winchester
Southampton
Lewes
Hastings
Eastbourne
Exeter
Portsmouth
Brighton
Newhaven
I. of Wight
Truro
Weymouth
Bournemouth
Penzance
Falmouth
Plymouth
to Havre
to Channel Is.
Dieppe
Calais
Boulogne
Ostend
Flushing
BELGIUM
FRANCE
IRELAND
to Copenhagen & the Baltic Sea
to Bergen
to Copenhagen & the Baltic Sea
to Hamburg
to Copenhagen & the Baltic Sea
to Hamburg
to Rotterdam
to Hamburg
to Hook of Holland

Barcelona to Madrid, via Zaragoza (214 miles), is 426 miles; and from Zaragoza there is a line to Alasua on the line from Irun to Madrid (see *Spain*).

4. *Madrid-Gibraltar.*—From Madrid, Gibraltar is reached via Algeciras (463 miles), running southwards over the line to Sevilla (360 miles), via Alcazar de San Juan (92 miles) and Manzanares, as far as Cordoba (275 miles), where the line from Malaga is joined and followed as far as Bobadilla. From Bobadilla the line runs via Ronda to Algeciras, where the steamer is joined for Gibraltar, 5½ miles away.

5. *Paris-Rome.*—Leaving the P.L.M. station, the P.L.M. line [2(*a*)] is followed as far as Dijon; thence via the Paris-Constantinople line [6] through Domodossola to Milan; and on via Lodi and Piacenza to Parma, Modena, and Bologna. From Bologna the line runs through Pistoja and Florence, and through Central Italy to Arezzo and Terontola; past Lake Trasimene to Orte, Monterotondo, and Rome. From Milan to Rome is 418 miles [6(*c*)]. Ancona is reached from Bologna and Orte.

6. *Paris-Constantinople.*—This is the route followed by the Simplon-Orient express. (*a*) From the P.L.M. station along the P.L.M. line to Dijon is 196 miles. (*b*) Thence Lausanne (121 miles) is reached via Mouchard, Frasne, Vallorbe. (*c*) The third stage is Lausanne to Milan (192 miles), along the north shore of the lake of Geneva, past Vevey, Montreux, and Villeneuve; thence southwards along the Rhône Valley to Roche, Aigle, St. Maurice, following the eastward bend of the valley to Sion and Brig (90½ miles). (*d*) Brig is the entrance to the great Simplon Tunnel (through the Alps); and here the line joins that from Berne, via Thun and Spiez on the southern shore of the Thuner See, passing across the Bernese Oberland via Kandergrund and the Kander Tunnel. Berne to Brig is 72 miles. (*e*) Brig to Domodossola (Italy) through the Simplon Tunnel is 25½ miles. (*f*) From Domodossola the Simplon express traverses the west shore of Lake Maggiore, running via Pallanza, Baveno, and Stresa to Arona, Gallarate, and Milan (76½ miles from Domodossola). (*g*) Milan (Centrale) to Venice is 165 miles, via Brescia, Desenzano (on the Lake of Garda), Verona, Vicenza, and Padua. (*h*) Venice to Trieste (q.v.) is 99 miles, via Mestre and Portogruara to Monfalcone; thence by way of Nabresina. (*i*) Trieste to Postumia is 52 miles. The express leaves Trieste (Centrale) and runs via Nabresina to Sesana, Divaccia, and San Pietro (Sankt Peter), the junction for Fiume; thence to Postumia (Adelsberg) and (*j*) over the frontier of Yugoslavia to Laibach (Ljubljana). Postumia to Ljubljana is 38 miles.[1] (*k*) Zagreb (Agram) is reached from Ljubljana via Steinbrück, and the line is continued across Slavonia to Vinkovce [2]. From Vinkovce the express runs by India [3] and Semlin (Zimony) to Belgrade (for Nish by way of the Marava Valley, thence to Salonika and Athens); and from Belgrade across Bulgaria via Tsaribrod to Sofia; south-westwards thence to Adrianople, and from Adrianople by the Maritza and Ergene Valleys to Constantinople. Belgrade to Constantinople is 659 miles.

7. London- $\left\{\begin{array}{l}\text{Dover-Calais}\\ \text{Dover-Ostend *}\end{array}\right\}$ -Brussels.

* Belgian State Railways and Mail Packet Services.

8. *Brussels-Hamburg*, via Liége, Herbesthal, Aix-la-Chapelle, Cologne [see 12], Düsseldorf, Oberhausen (for Hamm, Hanover, Stendal (q.v.), and Berlin), Haltern, Bremen [4]. (*a*) Hamburg-Warnemünde, via Lubeck and Rostock. (*b*) Berlin-Warnemünde, via Neu Strelitz. (*c*) Warnemünde by steamer to Gjedser (on Falster) for Copenhagen. (*d*) Hamburg-Kiel, via Altona; steamer to Korsör (for Copenhagen). (*e*) Hamburg-Sassnitz Hafen, via Rostock and Stralsund. (*f*) Berlin-Sassnitz Hafen. (*g*) Steamer, Sassnitz Hafen-Trelleborg; thence via Malmö to Stockholm, Göteborg, and Christiania.

9. *Copenhagen-Stockholm* (by steamer to Malmö).

10. *Berlin-Riga* (q.v.), via Schneidemühl (for Thorn and Warsaw), Dirschau (for Danzig, see *Stettin*), Gumbinnen, Eydtkuhnen (for Wirballen, Kovno, Riga). See *Prussia, East* (section *Communications*).

11. *Berlin-Warsaw* (for Moscow), via Frankfurt-am-Oder, Posen (q.v.), Thorn, Alexandrowo.

12. [See 8.] *London-Cologne*, via Folkestone and Flushing (Vlissingen). From Victoria to Folkestone is 70 miles; Folkestone to Flushing is 100 miles; thence via Roosendaal to Breda, where a line from Rotterdam (31 miles) joins; and via Tilburg, Boxtel, Eindhofen (for Liége, 68½ miles, via Hasselt), and Venlo to Crefeld, Neuss (for Düsseldorf), and Cologne [15 (*a*), (*b*)]. Breda is 68 miles from Flushing.[5]

13. *London-Central Europe*, via Harwich and Hoek van Holland. Hook of Holland, via Schiedam, to Rotterdam is 17½ miles. Rotterdam is the junction for The Hague (15½ miles) and Amsterdam (54 miles). From Rotterdam the line runs across Holland, via Utrecht, Amersfoort, Rheine, to Osnabrück, Lönn, Minden, Hanover (for Brunswick, Stendal, Berlin). From Hanover to Brunswick is 87½

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[1] See *Styria*.

[2] Vinkovce is a junction for the Banat; a line runs to Temisoara; thence to Orsova and Bucharest (for Constanta and steamer to Constantinople). There is a through service from Trieste to Boulogne. The Simplon-Orient express runs between Paris and Constantinople; the return journey is performed by the Orient-Simplon express. Both services also serve Athens.

[3] India = Indjija.

[4] See *Syke*.

[5] See *Rhenish Prussia*.

miles; thence the line runs, via Magdeburg, Halle, Leipzig, and Riesa, to Dresden (242 miles from Hanover). Dresden is a junction for the Berlin-Vienna (400 miles) line, some 120 miles from Berlin and 119 miles from Prague.

14. *London-Bucharest.*—

$$(a)\ \text{London-}\left\{\begin{array}{l}\text{Ostend-Brussels (Nord)-}\\ \quad\text{Luxemburg}\\ \text{Calais-Paris (Est)-Sar-}\\ \quad\text{rebourg}\end{array}\right\}\text{-Strasbourg.}$$

(*b*) From Strasbourg the line runs across the Rhine, via Kehl, to Appenweier, where it joins the line from Basel, via Offenburg, and runs down the right bank of the Rhine, via Baden-Baden, to Karlsruhe, Durlach, and Bruchsal, the junction for Stuttgart, via Mühlacker. From Stuttgart the route is via Cannstatt to Ulm, thence to Munich, the Bavarian capital, via Günzburg and Augsburg. Stuttgart to Munich is 150 miles. Leaving Munich, the frontier is crossed at Salzburg (q.v.), and Vienna is reached. Stuttgart to Vienna is 440 miles. At Vienna lines for Bucharest, Budapest, and Belgrade have their nodal point. (*c*) Vienna to Bucharest is 723 miles, and Vienna to Budapest is 173 miles. For Budapest the line runs out of the Ostbahnhof to the Czecho-Slovakian frontier at Bratislava (Pressburg), crosses Southern Slovakia, and then enters Hungary. From Budapest (Westbahnhof) direct connection is afforded with Bucharest, via Szolnok, Bekescsaba, and Ketegyhaza, and over the Roumanian frontier to Arad; thence across Transylvania, by way of Segishoara, Brasov, Predeal, Sinaïa, and Ploesti, to Bucharest. (*d*) Vienna to Budapest, via Bruck and Györ to the Czecho-Slovakian frontier at Komorn, is 168 miles. (*e*) Vienna to Belgrade is 391 miles from the Ostbahnhof, running south, via Kis-Körös, to Szabadka, and across the Danube to Semlin (Zimony) and Belgrade. (*f*) Belgrade to Constantinople. There is direct communication via Nish and Sofia; Vienna to Constantinople is 1050 miles.

15. *Cologne-Vienna.*—

$$(a)\ \text{London-}\left\{\begin{array}{l}\text{Ostend-Brussels-}\\ \quad\text{Herbesthal}\\ \text{Rotterdam-Nymegen-}\\ \quad\text{Crefeld}\end{array}\right\}\text{-Cologne [8; 12].}$$

(*b*) From Cologne the railway follows a south-easterly direction along the right bank of the Rhine, via Beuel, Linz, Neuwied, Vallendar, and Niederlahnstein (for Coblenz), to Eltville (for Schlangenbad, 5 miles), Wiesbaden (for Mainz), Kastel, Höchst, and Frankfurt. Cologne to Frankfurt is 140 miles. Leaving Frankfurt, and running over the Bavarian railways, Würzburg is reached, via Hanau, Aschaffenburg, Gemünden, and the Main Valley; thence to Nürnberg (for Karlsbad and Baireuth); and from Nürnberg south-east to Regensburg (Ratisbon) and Passau (Austrian frontier), where the Salzburg-Vienna line (see *Salzburg*) is joined and followed to Vienna, via Linz, Amstetten, St. Polten. Cologne to Vienna is 687 miles.

Canadian Railways.—The Canadian National system has a mileage of 22,757, and is easily the greatest State-owned railway system in existence. The main divisions and their mileages are as follows:

	Miles.
Canadian Northern	9320·15
Grand Trunk	3567·07
Grand Trunk Pacific ..	1681·58
,, ,, (Branches) ..	1032·63
National Transcontinental ..	2002·92
Intercolonial	1592·35
Total ..	19,196·69

The Transcontinental lines of the National system, from Montreal to Vancouver, have a total distance of 2937·5 miles, and attain an altitude of 3650 feet at Lucerne. Toronto to Vancouver service is *via North Bay.* Montreal to Winnipeg is 1309 miles. Winnipeg to Prince Rupert is 1751 miles, the line attaining an altitude of 3714 feet at Mount Cavell. The Canadian Pacific Railway has a mileage of about 14,000, and the through line to Vancouver from Montreal has a length of 2886 miles, reaching an altitude of 5218 feet at Hector. Toronto is connected with this line, via Sudbury Junction, by a line (260 miles) along the shores of Georgian Bay. Toronto to Vancouver is 2706 miles. Besides the Canadian Pacific system, the company controls the Mineral Range (100 miles), Minneapolis, St. Paul, & Sault Ste. Marie (4243 miles), and the Duluth, South Shore, & Atlantic (621 miles) Railways. Among a multitude of smaller lines, the Temiskaming & North Ontario Railway, with a total mileage of 470, is of great economic importance. It is the property of the Ontario Government.

A great deal of miscellaneous information regarding railways is scattered throughout the *New Gresham Encyclopedia* in connection with articles on places, provinces, and countries, &c. Under *Spanish Town* the Jamaican railway system is outlined; under *Rio Grande do Sul* there is a note on Brazilian railways; and the Salvadorian system is summarized under *Union, La.* See also (for example) *Poti*; *South-West Africa*; *Tirol*; *Trieste*; and consult the Index.

Syzran, or **Sysran**, a town of Central Russia, in the former government of Simbirsk, on the Volga. It has tanneries, flour-mills, &c., and exports grain. Pop. 46,000.

Syzygy (si′zi-ji), in astronomy, the conjunction or opposition of any two of the heavenly bodies. See *Moon*.

Szarvas (sár′vásh), a town of Hungary, on the

Körös. It is an agricultural centre. Pop. 28,500.

Szatmar-Nemeti, a town of Roumania, formerly a royal free town of Hungary, on the Szamos. Pop. 35,000.

Szechwan, a western frontier province of China, the largest in the Republic. Ch'êngtu is the capital. Area, 218,480 sq. miles; pop. 54,500,000.

Szeged, or **Szegedin**, a city of Hungary, at the confluence of the Maros and Theiss. It is a great commercial centre, with large salt and tobacco magazines, and a considerable shipping trade, especially in coal and timber, and is the second city of Hungary. Pop. 120,000.

Szolnok (sol'nok) a market town and railway junction of Hungary, on the Theiss and the Zagyva. It is an agricultural centre. Pop. 28,000.

T

T, the twentieth letter in the English alphabet, a sharp mute consonant, representing the sound produced by a quick and strong emission of the breath after the end of the tongue has been placed against the roof of the mouth near the roots of the upper teeth. By Grimm's law *t* in English corresponds to *d* in Latin, Greek, and Sanskrit, and to *ss* or *z* in German.

Tabas'co, a maritime state of Mexico, between Yucatan Peninsula and Vera Cruz; area, 10,874 sq. miles. It consists almost entirely of a great flat, sloping northwards to the Gulf of Mexico. Villa Hermosa is the capital. Pop. 187,580.

Tab'asheer, or **Tabashir** (Persian), a siliceous concretion resembling hydrophane, sometimes found in the joints of bamboos and other large grasses. It is highly valued in the East Indies as a medicine, but its virtues are merely imaginary.

Tabernacle (Lat. *tabernaculum*, small hut), in Jewish antiquities, the tent or sanctuary in which the sacred utensils were kept during the wanderings of the Israelites in the desert. It was in the shape of a parallelogram, 45 by 15 feet, and 15 feet in height, with its smaller ends placed east and west, and having its entrance in the east. Its framework consisted of forty-eight gilded boards of shittim-wood, bound together by golden rings and set into silver sockets; and this framework was covered with four carpets. The interior was divided by a curtain into two compartments, the outer the 'sanctuary' proper, and the innermost the holy of holies. In the sanctuary was placed on the north the table of shew-bread, on the south the golden candlestick, and in the middle, near the inner curtain, the altar of incense. In the centre of the holy of holies stood the ark of the covenant. The tabernacle was situated in a court 150 by 75 feet, surrounded by costly screens 7½ feet high, and supported by pillars of brass 7½ feet apart, to which the curtains were attached by hooks and fillets of silver. In the outer or eastern half of the court stood the altar of burnt-offering, and between it and the tabernacle itself the laver for the ablutions of the priests. Modern critics do not admit that the Jews could have possessed such a structure in their wanderings.

Tabernacles, Feast of, the last of the three great festivals of the Jews which required the presence of all the males in Jerusalem. Its object was to commemorate the dwelling of the Israelites in tents during their sojourn in the wilderness, and it was also a feast of thanksgiving for the harvest and vintage. The time of the festival fell in the autumn, when all the chief fruits were gathered in, and hence it is often called the 'feast of the ingathering'. Its duration was strictly only seven days, but it was followed by a day of holy convocation of peculiar solemnity. During the seven days the people lived in booths erected in the courts of houses, on the roofs, and in the court of the temple. It was the most joyous festival of the year.

Tabes is a term used to describe a state of gradual progressive emaciation of the body. The term is most frequently used in relation to two diseases: tabes mesenterica, which is abdominal tuberculosis (q.v.) in children; and tabes dorsalis, or locomotor ataxia, one of the commonest of the chronic diseases of the nervous system.

Table-land. See *Geography*.

Table Mountain, a mountain of South Africa, south of Table Bay, its highest point being right over Cape Town. It is about 3580 feet high and level on the top. It joins the Devil's Mount on the east, and the Sugar Loaf or Lion's Head on the west.

Tables, Mathematical. A table is a collection of the numerical values of a function for a series of values of its argument or arguments. In general, the data brought together in a table are useful for their own sake; but some tables, notably those of common logarithms, are chiefly valuable as aids to arithmetic. Tables of quarter-squares, for example, allow the product of two numbers to be found by addition and subtraction, from the formula $ab = \frac{1}{4}(a + b)^2 - \frac{1}{4}(a - b)^2$; J. Blater's *Table of Quarter-Squares* (London,

1888) gives by this method the product of any two 5-figure numbers. P. Barlow's *Tables* (London, 1840), which are extensively used, give squares and cubes, with square roots and cube roots, of numbers to 10,000; and also reciprocals to 9 or 10 places. G. A. Jahn's *Table of Square and Cube Roots* (Leipzig, 1839) gives these to 25,500.

Before the invention of logarithms, the most important tables were those of the trigonometrical functions, such as the sine and the cosine. George Joachim Rheticus (1514–76) is famous for his tables of this kind, on which he is said to have had computers constantly at work for twelve years. His *Opus Palatinum* gives all the ratios to 10 places for every 10 seconds from 0° to 90°.

The calculation of the common logarithms of numbers and of the trigonometrical ratios is almost entirely due to Henry Briggs, and to the Dutchman Adrian Vlacq, who followed Briggs and completed his work. The *Arithmetica Logarithmica* of Briggs appeared in 1624, and his *Trigonometria Britannica* in 1633. The latter contains log sines (to 14 places) and log tans (to 10 places) for every hundredth of a degree in the first quadrant. V. Bagay's *Nouvelles Tables* (Paris, 1829) contains complete results for the logarithms of the trigonometrical ratios to every second, and has been much used by computers. R. Shortrede's *Logarithmic Tables* (Edinburgh, 1849) also gives the trigonometrical canon complete to every second. A famous set of tables, never completely printed, but always available in manuscript, is the *Tables du Cadastre* of Prony, commenced in 1784 at the instance of the French Government. In 1891 an abridgment was published officially, in the form of an 8-figure centesimal table to every 10 seconds. Edward Sang's *Tables* (1871) give 7-figure logs of numbers from 20,000 to 200,000, and those of W. W. Duffield (1896) give 10-figure logs to 100,009.

Among more miscellaneous tables, a very popular set has been that of C. Hutton (1785), which contains hyperbolic logs to 1200 to 7 places. F. Callet's *Tables Portatives* (Paris, 1783 and 1853) is a very complete collection of tables of ordinary and hyperbolic logs. Tables by G. Vega and by J. C. Schultze have been much used. The latter contains Wolfram's table of hyperbolic logs of numbers below 10,000 to 48 places. Barlow's *Tables*, already mentioned, give 8-place hyperbolic logs. The collections of Luvini and Chambers are suitable for use in schools. In J. B. Dale's 5-figure tables, among the functions tabulated are elliptic functions, the gamma function, zonal harmonics, and Bessel Functions. The more recent *Funktionentafeln* of Jahnke and Emde also contains matter of this type, with many of the relative formulæ. Tables of e^x and e^{-x} are given by F. W. Newman and by J. W. L. Glaisher in the *Cambridge Philosophical Transactions*, vol. xiii, pp. 145 and 243. For the Bessel Functions, extensive tables are given in the treatise on these functions by Gray, Mathews, and MacRobert. Many tables have been published of the kind required in actuarial work; a short set is appended to the *Institute of Actuaries' Text-book.* — BIBLIOGRAPHY: *British Association Report for 1873*, p. 6; R. Mehmke, article *Numerisches Rechnen* in vol. i, part 2, pp. 941–1079 of the *Encyklopädie der Mathematischen Wissenschaften.*

Tables, The, in Scottish ecclesiastical history, the permanent council held in Edinburgh for managing the affairs of the Covenanters during the reign of Charles I, said to have been so named from a green table at which the members sat.

Taboo, a Polynesian word used to denote something consecrated, sacred, forbidden to be touched, or set aside for particular uses or persons. It is applied both to persons and things, and both to the object prohibited and to the persons against whom the prohibition extends. The word taboo was introduced into English by Captain Cook, who became acquainted with it in 1777 at Tonga. The institution of taboo has been variously explained. It has been regarded as a cunning piece of statecraft, devised by priests and political chiefs; as a religious observance; and as an inherent tendency in man. It may also be the expression of conservatism, social and religious. Anyhow, the belief in a mysterious spiritual potency and fear were the chief causes inspiring taboo.— BIBLIOGRAPHY: Sir J. G. Frazer, *The Golden Bough*; F. B. Jevons, *An Introduction to the History of Religion.*

Tabor, a town of Czecho-Slovakia, on the River Luznitz. Its castle was a stronghold of the sect of Hussites called Taborites, and there are old walls. Altitude, 1470 feet. Pop. 12,000.

Tabriz′ (ancient Tauris), a city of Persia, capital of the province of Azerbaijan, on the Aigi, 36 miles above its entrance into Lake Urumiyah. It is surrounded with a wall of adobe, and has mosques, bazaars, baths, and caravanserais. There are manufactures of silks, cottons, carpets, and leathers, &c., and Tabriz is the commercial metropolis of North-Western Persia. During the European War the town was seized by the Turks in 1915, and again in 1918. In 1922 it was for a short time in the possession of Caucasian Bolsheviks. Pop. about 200,000.

Tacahout (tak′a-hṳt), the small gall formed on the tamarisk tree (*Tamarix indica*). It is imported into Britain for the sake of its gallic acid, and is used as a mordant in dyeing and in tanning.

Tacamahac′, the name given to a bitter balsamic resin, the produce of several kinds of trees belonging to Mexico and the West Indies, the East Indies, South America, and North America. The balsam-poplar or tacamahac is one of these. See *Calophyllum.*

Tachometers and Tachographs, instruments for the measurement and recording of speed of running of machinery. The usual principle on which they operate is that two revolving masses of metal are free to move outwards from one another within the limits imposed by their connection by springs. The position they take up will vary according to the speed at which they are revolved, and motion is taken from them or from a sleeve connected to them through gearing or levers to operate the pointer on the scale. If the instrument is to be a recording one, a pen with a small well of ink is fixed to the head of a long thin arm, and its travel on a paper indicates the change of speed. The drum on which the paper is held is usually operated to revolve by means of clockwork, and thus a time record of the change of speed may be obtained. Vibrating reeds of different natural frequencies are used on some instruments to show the speed of running of such a plant as a steam turbine. The reeds are usually mounted at the back of the instrument, and their white ends are visible through a slot in the dial beside the scale. As the speed of the machine is raised, one after another of the reeds is set in vibration, and as a calibrated scale is provided, the actual speed at any moment may be observed. Speed counters are commonly used in testing. In them a shaft is made to revolve at the same speed as the plant by actual contact with the end of the machine shaft, and gearing drives a dial round past an index-mark to show the number of revolutions performed while the instrument is in use.

Tachylyte (often misspelled *tachylite*), a pitchstone of basaltic composition, found on the rapidly cooled sides of volcanic dykes or on the surface of some basic lava-flows.

Tacitus, Cornelius, Roman historian, was born about A.D. 55, and died about A.D. 120. The few facts which are known about him are derived from his own works, and from the *Letters* of the younger Pliny, who was his intimate friend. He began his public career as quæstor under Vespasian, and was tribune or ædile under Titus. Nothing is known of his family, nor is his prænomen known for certain. He became a very successful barrister, and married the daughter of the distinguished soldier Julius Agricola. In the reign of Domitian, Tacitus was prætor at the celebration of the secular games. He became consul in A.D. 97, and in 99 was associated with Pliny in the prosecution of Marius Priscus, the extortionate governor of Africa. Tacitus seems to have been alive in A.D. 117, but probably died a few years after that date.

The extant works of Tacitus are few and fragmentary, but upon them rests a reputation unsurpassed by that of any Roman prose writer. His earliest work, the *Dialogus de Oratoribus*, was written about A.D. 76. Its authorship has been denied to Tacitus, as its style is not Tacitean, but this reason for scepticism is insufficient, as the true Tacitean style was probably a slow and a late growth. The *Dialogus* throws an interesting light upon Roman education. The *De Vita et Moribus Julii Agricolæ* is Tacitus's pious tribute to the memory of his father-in-law. It is one of the finest short biographies ever written, and is of especial interest to Britons on account of the sketch which it gives of the British Isles. The *De Germania* has something of the air of a pamphlet with a purpose. It exploits the fallacy of the 'noble savage', in order to attack the degeneracy and servility of contemporary Rome. It is not critically written, and may be regarded as a contribution to ethics rather than to history. The *Histories* are the greatest of the extant works. They were written in twelve books, and covered the years A.D. 69 to 97. Only four books and a small part of the fifth book are preserved. The extant books give a detailed account of the events of the year 69, the fateful 'year of the four emperors'. The fragmentary fifth book gives a picturesque but inaccurate account of the Jews. The *Annals* recorded the history of the reigns of the emperors from Tiberius to Nero inclusive, but only nine books are entire; the whole of the reign of Caligula, the first six years of Claudius, and the last three years of Nero are wanting. The Emperor Tacitus, who was proud to claim descent from the historian, during his brief reign enacted that ten copies of the works of Tacitus should be transcribed yearly at the public expense, and placed in the public libraries. The fact that, in spite of this multiplication of copies, his works are so imperfectly preserved, shows that Tacitus must always have been "caviare to the general". His style is unique. He is a master of biting phrase and innuendo, and his language is unequalled for audacity, force, conciseness, and condensation. He is as great a literary artist as Virgil, whom he admired and frequently imitated. In the works of Tacitus also is to be found "All the charm of all the Muses often flowering in a lonely word". No prose writer equally repays constant study and re-reading. This 'lord of language' charms his readers into forgetting that he is not an impartial historian, and that some of his most embittered passages are based upon the ravings of the madwoman Agrippina.—BIBLIOGRAPHY: G. Boissier, *Tacitus and other Roman Studies* (translated by W. G. Hutchinson); A. J. Church and W. J. Brodribb, *Tacitus—History, Agricola, Germany, and the Dialogue on Oratory* (translation); W. B. Donne, *Tacitus* (Ancient Classics for English Readers Series).

Tack, in navigation, the course of a ship in regard to the position of her sails and the angle at which the wind strikes them. Tacking is an operation by which a ship is enabled to beat up against a wind by a series of zigzags, the sails being turned obliquely to the wind first on one side and then on the other.

Tackle, a combination of pulleys and ropes or chains, the use of which facilitates the handling of heavy loads. When a rope is passed over a single pulley, a load applied to one end of it may be raised by a downward pull on the other end. Such an arrangement is merely used for the convenience it affords, as no mechanical advantage is obtained from it. If, however, there are many pulleys in use, and they are arranged in two blocks, the rope being passed over a pulley in each block in turn, a great mechanical advantage is procurable. At the same time, the velocity ratio is changed, and the speed of lifting is decreased. Neglecting friction, the rope or chain has the same tension throughout, and the mechanical advantage would be the same as the number of rope or chain lengths which take the pull. A method of obtaining a high mechanical advantage without the use of a large number of pulleys is embodied in the design of the Weston type of block. In that arrangement there is a single pulley below, but a double one above. The pulleys of the top block, however, are cast in one piece, so that they run together. The chain is an endless one, and passes over the pulleys in turn. With such a system the amount of chain hauled in for one complete revolution of the upper pulleys is the difference of their circumferences, and the load will be lifted through half that amount. Neglecting friction, the equation connecting the load W and the effort P is

$$P\pi D = W\cdot\frac{\pi}{2}\left(D - d\right),$$

where D and d are the two diameters of the upper pulleys. The smaller the difference in the diameters, the greater will be the mechanical advantage. A useful feature of this type of block is that, thanks to the large amount of friction in the upper block, the tackle does not *overhaul*, i.e. the load does not run back when the effort ceases.

Tacna-Arica. Tacna is to all intents and purposes the northernmost province of Chile, having been annexed by that country from Peru after the war of 1879–82. Under the third clause of the Treaty of Ancon (see *Peru, History* section), Chile, who had occupied the province in 1883, maintained her hold over it, but agreed to a plebiscite, which should have been taken in 1894, although it has never materialized. The true position is that Chile did not know at the time the immense value of the Tacna-Arica region, which has since revealed nitrate deposits which have been estimated as workable for some five hundred years. By the Treaty of Ancon, Peru was to pay 10,000,000 *soles* on the redemption of her lost territory; but now Chile prefers the province, and has hitherto been successful in keeping it. A most important feature of any negotiations must be the claim of Bolivia, the third largest state of Latin-America, and a mine of mineral wealth. Bolivia is, since the Treaty of Ancon, an inland state, and she insists on her moral right to a 'window' on the Pacific. Apart from her genuine and pressing economic need, such a 'window' would be the only preventive of her political strangulation, the present wholesale robbery of her merchants by those on the coast, and the subordination of her national ideals and her very independence to Chilian politics, upon the goodwill of which she is now dependent for intercourse with the rest of the world. Area, 8999 sq. miles; pop. 38,900. Tacna, or San Pedro de Tacna, on the River Tacna, is the capital, and is about 40 miles distant from its port, Arica. Pop. 10,000.—Cf. Sir C. R. Markham, *The War between Peru and Chile (1879–1882)*.

Taco'ma, a seaport-city of Washington, United States, the county seat of Pierce county, on an arm of Puget Sound, terminus of the Northern Pacific Railroad, a rising place with two universities, various industries, extensive docks, and trade in grain, lumber, coal, &c. Founded in 1868, it became a city in 1883. Pop. (1920), 96,965.

Tactics. See *Strategy and Tactics.*

Tadoussac, a town of Quebec, Canada. It is a health-resort and tourist centre at the Saguenay-St. Lawrence confluence. Pop. 500.

Tadpole. See *Frog.*

Tael. See *China (Commerce).*

Taff'eta, originally the name applied to all kinds of plain silks, but now generally used as a kind of generic name for plain silk, gros de Naples, gros des Indes, shot silk, glacé, and others. The term has also been applied to mixed fabrics of silk and wool.

Tafilelt, an oasis of the Sahara, in the French Zone of Morocco, 200 miles south of Fez. It is the cradle of the Moroccan dynasty.

Taft, William Howard, twenty-seventh President of the United States, born in 1857. The son of an eminent United States lawyer and diplomat, he was educated at Yale, and called to the Bar in 1880. After some experience as a journalist and in lesser official posts, he was sent to the Philippines, of which islands, in 1901, he was appointed first Civil Governor, thus becoming responsible for the re-erection of the fabric of just and orderly government on the smouldering ruins of Spanish misrule. Here his talents were seen at their best, and Taft's ability and success were recognized by President Roosevelt, who appointed him Secretary for War, and supported his successful candidature in the presidential elections of 1909. In 1918, on the expiry of his term of office as President, he became Kent law professor of his old university. During the European War he supported the American policy of neutrality, but on the entry of the United States he assisted the Allied propaganda. In 1921 he became Chief Justice of the Supreme Court, and since the Treaty of Versailles he has been an active supporter of the League of Nations. Among his works are: *The Presidency: its Duties, its Powers, its Opportunities, and its Limitations*; and *Ethics in Service.*

Taganrog, a seaport of Russia, on the northern shore of the Sea of Azov. The chief export is grain. Pop. 68,370.

Tagetes, a genus of herbs, order Compositæ, natives of the warmer parts of America. *T. signata* is grown in gardens under the name of African marigold.

Tagliamento (ancient **Tilavemptus**), a river of Venetia, North Italy, rising in the Carnic Alps and flowing eastwards and then southwards across the Friulian plain and the province of Udine, falling into the Adriatic (Gulf of Venice) after a course of 110 miles. In classical times the Tagliamento Valley was followed by the Roman road from *Aquileia* to *Julium Carnicum* (Zuglia).

During the European War the Tagliamento, swollen by the autumnal rains, played a great part in saving the Italian army from complete annihilation after the collapse (Oct., 1917) of the Second Army at Caporetto (see *European War*, section *Italian Campaign, 1917*), when a general retreat to the Piave (q.v.) was begun. To carry out this retreat successfully it was necessary to make a stand along the line of the Tagliamento, and especially to protect the three permanent bridges, one of which, at Casarsa (south-west of Udine), was destroyed in error on 28th Oct., cutting off thousands of men and a train of guns several miles long. Some of these troops reached the bridge at Latisana and hampered the movements of the Third Army, who were carrying out a slow, methodical retreat under cover of cavalry and motor machine-guns under the Count of Turin, and protected by the 6th and 8th Corps, who fought savage rearguard actions on the Isonzo and before Udine. Italian troops, who had been sent to oppose the Austro-German crossing in the region where the Tagliamento emerges on the Friulian plain, defeated the Austrians at Pinzano, but were ultimately forced to retire by sheer weight of numbers. The whole of the Italian army was not demoralized after Caporetto, and, generally speaking, the retreat to the Piave was remarkable, although there were unnecessary losses in *matériel*, and a few gross blunders. Ludendorff himself did not anticipate a retirement of such magnitude (which was entirely due to the disaffected Second Army), and, as a consequence, he was not ready to follow up his momentary advantage to the full, and to extirpate the entire Italian army during its retirement.

Taglioni (tȧl-yō′nē), Marie, Italian ballet dancer, born 1804, died 1884. She was trained by her father, an Italian master of the ballet; appeared at Vienna in 1822, at Paris in 1827, and at London, where she created a great sensation, in 1838. She visited all the capitals of Europe, and was acknowledged the first ballet dancer of her time. In 1847 she retired from the stage, but subsequently, losing her savings in speculation, she supported herself in London as a teacher of deportment.

Tagore, Rabindranath, Bengali poet and novelist, was born in 1861. As a young man he spent a short while in England, where he studied law. In 1901 he founded the Shantiniketan (Abode of Peace) at Bolpur, and subsequently endeavoured to develop this institution into an international university. His poems include *Gitanjali* (Song Offerings), *The Crescent Moon*, *Songs of Kabir*, and *Stray Birds.* His plays include *The King of the Dark Chamber*, *The Post Office*, and *Sacrifice*; and his novels include *The Home and the World* and *The Wreck.* His works are regarded as classics in his own country, and most of them have been translated into English. He received the Nobel prize for literature in 1913. Tagore was knighted in 1915, but resigned his title in 1919 to signify his disapproval of British methods of dealing with rioters.

Tagus (Sp. *Tajo*, Port. *Tejo*), the largest river of the Iberian Peninsula, rising in the Sierra de Albaracin and flowing by Aranjuez, Toledo, Talavera, and Alcantara, enters Portugal, passing by Abrantes, Santarem, and Lisbon to the Atlantic; length, 540 miles.

Tahiti, the largest of the Society Islands, a French possession, mountainous and of volcanic formation, fringed by coral reefs; area, 600 sq. miles. Papeete is the chief place. Citrus fruits, bananas, bread-fruit, sugar, coffee, cocoa, cotton, vanilla, pearl-shell, and rum are among its products. Pop. 11,700.

Taiho'ku (formerly Taipeh), capital of the Japanese island of Taiwan (Formosa). Pop. (1919), 107,706.

Tailor-bird (*Orthotŏmus longicaudus*), a bird of the thrush family (Turdidæ), so named from its habit of sewing together leaves to form a nest; a native of India and the Eastern Archipelago.

Tain, a royal and municipal burgh of Scotland, in the county of Ross and Cromarty, on the Dornoch Firth, one of the Wick district of burghs. Pop. (1921), 1600.

Tainan, a town near the south-west coast of Taiwan, carrying on an extensive trade through the ports of Anping and Takow. It has rice- and sugar-mills. Pop. 60,000.

Taine, Hippolyte Adolphe, French historian, philosopher, and critic, born 1828, died 1893. He was appointed professor of æsthetics in the École des Beaux Arts in 1864, and was elected to the Academy in 1878. His *Essai sur Tite-Live*, crowned by the Academy, appeared in 1854, and was followed in 1856 by *Les Philosophes classiques français du XIX*^{e} *siècle*. In 1864 appeared his literary masterpiece, *Histoire de la littérature anglaise*. His other works include: *Essais de critique et d'histoire*, *De l'intelligence*, *Philosophie de l'art*, and *Les Origines de la France contemporaine*.

Tait, Archibald Campbell, British prelate, born at Edinburgh 1811, died 1882. Of Presbyterian descent, he was educated at Edinburgh, Glasgow, and Balliol College, Oxford, where he became Fellow and tutor. As one of the 'Four Tutors', he publicly opposed Newman in the Tractarian controversy. He was appointed headmaster of Rugby on the death of Dr. Arnold (1842), Dean of Carlisle (1850), Bishop of London (1856), and Archbishop of Canterbury in succession to Dr. Longley (1868). His primacy was marked by the disestablishment of the Irish Church, and by the Public Worship Regulation Act of 1874.—Cf. Davidson and Benham, *Life of Archibald Campbell Tait*.

Tait, Peter Guthrie, Scottish mathematician and physicist, born in 1831, died in 1901. He was educated at Edinburgh Academy, Edinburgh University, and Peterhouse, Cambridge, graduating as senior wrangler and first Smith's prizeman in 1852. In 1854 he went as professor of mathematics to Queen's College, Belfast, where he made the acquaintance of Sir William Rowan Hamilton, the inventor of quaternions (q.v.), a subject on which Tait himself subsequently wrote a standard treatise. In 1860 he was elected to the professorship of natural philosophy at Edinburgh University, and continued to hold this post till within a few months of his death. His earliest work, Tait and Steele's *Dynamics of a Particle*, was written partly in conjunction with W. J. Steele, who died, however, before the work was completed. Tait afterwards collaborated with Sir William Thomson (Lord Kelvin) in the production of a treatise on *Natural Philosophy*, one of the most important scientific works published in the nineteenth century. The original intention of the authors was to write a work dealing exhaustively with both dynamics and physics, but the partnership was dissolved when they had covered no more than kinematics, kinetics, statics, attractions, elasticity, and some parts of hydrodynamics. At a later date Tait published volumes on *Heat*, *Light*, and *Properties of Matter*. In his treatise on *Thermodynamics* he strongly defended the claims of Joule and of Thomson, as against those of the Germans Mayer and Clausius, to be the original discoverers of certain of the most important ideas of the new science. Tait had strong religious feelings, and was the joint author with Balfour Stewart of *The Unseen Universe, or Physical Speculation on a Future State*, which appeared anonymously in 1875 and attracted much attention. Besides the text-books mentioned and others, Tait wrote many articles and memoirs, including a remarkable series of papers on *Knots*; and his experimental and theoretical investigations on the flight of a golf-ball excited interest beyond purely scientific circles. In practical physics he did some valuable work, notably in thermoelectricity. He was awarded a Royal medal by the Royal Society in 1886, though he had never become a Fellow of the society, preferring to identify himself with the Royal Society of Edinburgh, of which for many years he was one of the secretaries. A selection from his works has been published in three volumes.—Cf. C. G. Knott, *Life and Scientific Work of P. G. Tait*.

Taiwan (tī-wȧn'), the Japanese name of the former Chinese island of Formosa (q.v.).

Talaat Pasha, Turkish statesman, born 1872, died 1921. From the Adrianople post office, where he was a telegraphist, Talaat, through the influence of Enver Pasha, became an important member of the Young Turk movement. With Enver he was directly responsible for Turkey's participation in the European War, and many Armenian massacres have been laid to his charge. He was a champion of the Pan-Turanian idea, but his war ambitions hastened the downfall and extinction of the Ottoman Empire. As Grand Vizier (1917–8), in succession to the Egyptian Prince Saïd Halim, who had been too moderate for the Committee, he was a signatory to the preliminary peace imposed upon Roumania (5th March, 1918), and a

Turkish delegate to Brest-Litovsk. In Oct., 1918, his position became untenable, and he resigned, being assassinated in Berlin (by an Armenian) on 15th March, 1921.

Talave'ra de la Reina (rä'i-nȧ), a city of Spain, province of Toledo, on the Tagus. In a great battle fought there (1809) Wellington defeated the French under Victor, Jourdan, and King Joseph. Pop. 12,000.

Talc, a hydrous magnesium silicate of crystalline texture, translucent, and often transparent when in very thin plates. A variety of talc called French chalk (or steatite) is used for tracing lines on wood, cloth, &c., instead of chalk (see *Potstone*; *Soapstone*; *Steatite*). The name talc is often erroneously given to varieties of *mica*.

Talca, a town of Chile, capital of the province of Talca, on the Claro. Ponchos are made. Pop. (1920), 36,079.—The province has an area of 3864 sq. miles, and pop. (1920), 133,957.

Talcahua'no, a seaport of Chile, in the province of Concepcion, with an arsenal, shipyards, &c. Pop. 16,000.

Talent, the name of a weight and denomination of money among the ancient Greeks, and also applied by Greek writers to various standard weights and denominations of money of different nations, the weight and value differing in the various nations and at various times. The Attic talent as a weight contained 60 Attic minæ or 6000 Attic drachmæ, equal to 56 lb. 11 oz. British troy weight. As a denomination of silver money it was equal to £243, 15*s.* The great talent of the Romans is computed to be equal to £99, 6*s.* 8*d.*, and the little talent to £75 sterling. A Hebrew weight and denomination of money, equivalent to 3000 shekels, also receives this name. As a weight it was equal to about 93¾ lb. avoir.; as a denomination of silver it has been variously estimated at from £340 to £396.—Cf. G. F. Hill, *Handbook of Greek and Roman Coins.*

Talfourd (tal'fụrd), Sir Thomas Noon, English author, born in 1795, died in 1854. He had a distinguished career at the Bar, becoming a sergeant-at-law in 1833, and a judge in 1849. As an author he is chiefly remembered for his *Ion* (1836); his other tragedies include *The Athenian Captive*, *Glencoe*, and *The Castilian.* He was a friend of Wordsworth and of Lamb; Dickens dedicated *The Pickwick Papers* and Browning *Pippa Passes* to him.

Taliessin, a Welsh bard said to have flourished during the twelfth or thirteenth century, and styled *Pen Beirdd*, ' the chief of the bards '. The *Book of Taliessin*, containing fifty-six poems, formerly attributed to Taliessin, is probably of a later date.

Talipot Palm (*Cory̆pha umbraculifĕra*), the great fan-palm, a native of Ceylon. The cylindrical trunk reaches a height of 60, 70 or 100 feet, and is covered with a tuft of fan-like leaves, usually about 18 feet in length and 14 feet in breadth. The leaves are used for covering houses, for making umbrellas and fans, and as a substitute for paper. When the tree has attained its full growth, the flower spike bursts from its envelope or spathe with a loud report. The flower spike is then as white as ivory, and occasionally 30 feet long. When its fruit is matured, the tree generally dies.

Talipot Palm (*Cory̆pha umbraculifĕra*)

Talisman (Gr. *telesma*, consecrated object), a figure cast or cut in metal or stone, and made, with certain superstitious ceremonies, at some particular moment of time, as when a certain star is at its culminating point, or when certain planets are in conjunction. The talisman thus prepared was supposed to exercise extraordinary influences over the bearer, particularly in averting disease. In a more extensive sense the word is used, like amulet, to denote any object of nature or art, the presence of which checks the power of spirits or demons, and defends the wearer from their malice. Relics, consecrated candles, rosaries, images of saints, &c., were employed as talismans in the Middle Ages; and at that time the knowledge of the virtues of talismans and amulets formed an important part of medical science.

Tallage, a tax levied by the Norman-English kings on towns and counties, as part of the revenues of the Crown, originally exacted probably in lieu of military service. It was abolished in 1340.

Tallegalla, or **Brush Turkey**, a remarkable bird belonging to the order Grallatores, family Megapodiidæ, or mound-birds (see *Megapodius*). The *Catheturus lathămi* is the best-known species, and that usually designated by the distinctive name of 'brush turkey'. It inhabits Australia, where it is also known by the names 'wattled tallegalla' and 'New Holland vulture'—this latter name having reference to the naked vulturine head and neck. The male when full grown is coloured of a blackish-brown above and below, with greyish tints on the back. The head and neck are covered with very small feathers of blackish hue, whilst a large wattle, coloured bright or orange yellow, depends from the front of the neck. These birds are remarkable on account of the huge, conical 'egg-mound' which they form, several of them jointly, for the purpose of therein depositing their eggs, which are greatly sought after on account of their delicious flavour.

Talleyrand - Périgord (tál-ā-ráṇ-pā-rē-gŏr), Charles Maurice de, Prince de Benevento, French diplomat, born at Paris in 1754, died in 1838. Against his personal inclination he entered the priesthood, in which his birth and ability procured him rapid advancement, and in 1788 he was consecrated Bishop of Autun. On the meeting of the States-General he was elected Deputy for Autun. He sided with the popular leaders in the revolutionary movements; and his advocacy of the abolition of tithes and the transference of Church lands to the State gained him great popularity. In 1790 he was elected president of the National Assembly. When the civil constitution of the clergy was adopted, he gave his adhesion to it, and ordained the first clergy on the new footing. For this he was excommunicated by a Papal brief, and thereupon renounced his episcopal functions (1791). In 1792 he was sent on a diplomatic mission to London, and while there was proscribed for alleged Royalist intrigues. Forced to leave England (1794) by the provisions of the Alien Act, he sailed for the United States, but returned to France in 1796. The following year he was appointed Minister of Foreign Affairs; but, being suspected of keeping up an understanding with the agents of Louis XVIII, he was obliged to resign in July, 1799. He now devoted himself entirely to Bonaparte, whom he had early recognized as the master spirit of the time, and after Bonaparte's return from Egypt contributed greatly to the events of the 18th Brumaire (10th Nov., 1799), when the Directory fell and the Consulate began. He was then reappointed Minister of Foreign Affairs, and for the next few years was the executant of all Bonaparte's diplomatic schemes. After the establishment of the Empire (1804) he became Grand-Chamberlain, and in 1806 was created Prince of Benevento. After the Peace of Tilsit (1807) he broke with Napoleon, and (1808) secretly joined a Royalist committee. In 1814 he procured Napoleon's abdication, and afterwards furthered the restoration of Louis XVIII. He took part in the Congress of Vienna, and in 1815, when the Allies again entered Paris, he became President of the Council with the portfolio of foreign affairs; but, as he objected to signing the second Peace of Paris, he resigned and retired for fifteen years into private life. When the revolution of July, 1830, broke out, he advised Louis Philippe to place himself at its head and to accept the throne. Declining the office of Minister of Foreign Affairs, he proceeded to London as Ambassador, and crowned his career by the formation of the Quadruple Alliance. He resigned in Nov., 1834, and quitted public life for ever.—BIBLIOGRAPHY: *Mémoires* (English translation by A. Hall); J. M'Cabe, *Talleyrand: a Biographical Study*; Lady Blennerhasset, *Talleyrand*; A. Pichot, *Souvenirs intimes de Talleyrand.*

Tallis, Thomas, author of some of the finest music in the cathedral service of the English Church, born about 1515, died in 1585. He served in the Chapel Royal during the reigns of Henry VIII, Edward VI, Mary, and Elizabeth.

Tallow consists of the purified fat of oxen (beef tallow) and sheep (mutton tallow). It is a hard, colourless, or pale-yellow grease, almost odourless when fresh, but acquiring a disagreeable smell on exposure to air. It consists of about 75 per cent stearin and palmitin and 25 per cent olein. Mutton tallow melts at about 47° C., and beef tallow, a softer variety, at about 44° C. The crude fat is first washed with water to remove blood and impurities, and then treated in a shredding apparatus to break up the cell walls which enclose the actual fat. The material is then 'rendered' either by melting with direct heat or by means of steam. In the first method the melting is carried out with constant stirring in an iron pan heated by an open fire. After standing for a short time the molten tallow is poured off from impurities, filtered, cooled to 35° C., and pressed. The residue consists of tallow, whilst the softer fat which is pressed out is known as oleomargarine, and is used for making butter substitutes. If the tallow is pressed at a still lower temperature, tallow oil, consisting mainly of olein, is obtained. On the large scale the rendering is usually carried out in a closed boiler by means of steam at a pressure of about 1¼ atmospheres, the melted fat being worked up as before; by this means a larger yield is obtained. Tallow is used as a lubricant, in the manufacture of soap (q.v.), and in leather dressing. It was largely used for the preparation of the old-fashioned tallow candles, but, owing to their objectionable smell, they have been superseded by stearin candles, which are made from the fatty acids derived from tallow.

Tallow Tree (*Stillingia sebifera*), a tree of the nat. ord. Euphorbiaceæ, one of the largest, the most beautiful, and the most widely diffused of the plants found in China. From a remote period it has furnished the Chinese with the material out of which they make candles. The capsules and seeds are crushed together and boiled; the fatty matter is skimmed as it rises, and condenses on cooling. The tallow tree has been introduced into the United States, and is almost naturalized in the maritime parts of Carolina. It has also been acclimatized by the French in Algeria. The tallow tree of Malabar is *Vateria indica.* See *Vateria.*

Tally, a wooden rod formerly much used as a method of keeping accounts. In the exchequer of England tallies were not abolished until 1782, but the Act which abolished them did not come into force until 1826. An exchequer tally was an account of a sum of money. The tally itself consisted of a wooden rod, having on one side notches, indicating the sum for which the tally was an acknowledgment, and on the two opposite sides the tallier's (i.e. modern teller) notes. The rod was cleft longitudinally in such a manner that each piece retained one of the written sides, and one-half of every notch cut in the tally. One of these parts, the *counterstock*, was kept in the exchequer, and the other, the *stock*, only issued. When the part issued was returned to the exchequer (usually in payment of taxes), the two parts were compared, as a check against fraudulent imitation. The size of the notches made on the tallies varied with the amount. The notch for £100 was the breadth of a thumb, for £1 the breadth of a barleycorn. A penny was indicated by a slight slit.

Tally System, a mode of selling upon credit upon the instalment system, of which hire-purchase and the fixed instalment systems are outcomes. See *Hiring.*

Talma, François Joseph, French tragedian, born 1763, died 1826. In 1787 he made his début at the Comédie Française as Séide in Voltaire's *Mahomet.* His greatest successes were achieved at the Théâtre de la République, which he and others founded in 1791. He enjoyed the intimacy of Napoleon, and was the friend of Chénier, Danton, Camille Desmoulins, and other revolutionists. Talma was the greatest modern tragic actor of France, and one of the earliest advocates of realism in scenery and costume.

Talmud, The. The *Talmud* is a corpus of the sayings of the Jewish rabbis of the first six Christian centuries. In theory it is an elaboration of the Law of Moses, and Rabbi Akiba in the second century described it as "a hedge about the Law". It comes in result to be an intricate system of casuistry attempting to meet every possible case which might occur, and so it deals with every imaginable subject. In spirit and subject-matter and method it is identical with the Muslim books of tradition of the tenth century. The word *talmud* is a Hebrew word meaning 'learning' or 'teaching'. The *Talmud* is made up of two strata, the Mishnah or text, and the Gemara or commentary upon the Mishnah. From the point of view of matter its contents are distinguished into Halakha, literally 'procedure', the legal portions; the stories and all the rest being Haggada, 'narrative'. The rabbis whose sayings are recorded in the Mishnah are called Tannaim, 'traditionists'; those who supply the material of the Gemara, Amoraim, 'sayers'. Sayings of the Tannaim which did not get into the Mishnah are called Baraita, 'extras'. They are found in the Gemara introduced by the words *tna Rabbanan*, 'the rabbis hand down', or the like. The Mishnah contains the teaching of the rabbis till about the year A.D. 200. It was collected by Rabbi Jehudah the Holy. Mishnah means 'repetition', that is, of the Law. It is in the late Hebrew language. The Gemara, 'completion', finishes about the year A.D. 600. Its language is Aramaic, and the later portions a mere jargon. The two together make up the *Talmud.* The plan is to give a few lines of Mishnah, followed by the Gemara upon it, which extends to two or three pages. There are two recensions or editions of the *Talmud*, the *Babylonian*, and the *Palestinian* or *Jerusalem Talmud.* The latter is considerably the shorter.

The *Talmud* is divided into six 'orders', Sedarim, whence the Jews call it Shas, from *shisshah sedarim*, 'six sedarim'. Each of these Seder (singular of Sedarim) contains from seven to twelve 'tractates', Massekheth, sixty-three (originally sixty) in all. The Tractates are not always connected with the order under which they fall. The orders are: (1) Zeraim, 'seeds', on agriculture and crops; (2) Moed, 'feasts'; (3) Nashim, 'women', on levirate, divorce, marriage; (4) Nezikin, 'damages', on civil and criminal law; (5) Kodashim, 'holy things', offerings and vows; (6) Teharoth, 'cleansings', ceremonial ablution. The following subjects are dealt with in the Tractates: under Order I, prayers, heave-offerings, tithes; under II, the Sabbath, the half-shekel tax; under III, vows, the law of the Nazarite; under IV, the Sanhedrin, idolatry, 'sayings of the Fathers'; under V, the measurements of the Temple; under VI, leprosy, the red heifer, baths, sacred books. In the *Babylonian Talmud* at the end of Order IV seven uncanonical Tractates are inserted, of which the most important are the sayings of

Rabbi Nathan and Soferim ('scribes'). It was forbidden to write the Oral Law, and the whole of this mass of tradition was carried in the memory. Some, however, think it was written down almost at once.

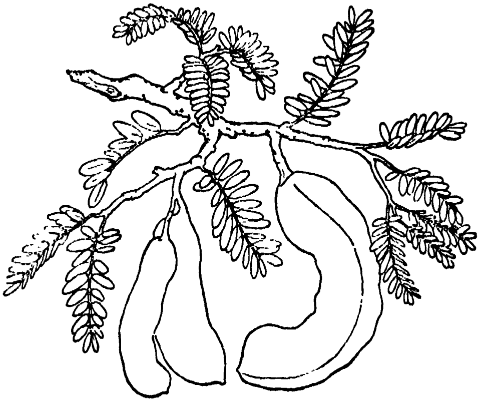
The best known of the early rabbis are Hillel and Shammai, each of whom founded a school. Hillel's son, or grandson, Gamaliel was the teacher of St. Paul. After the fall of Jerusalem the rabbis removed to Jabneh. Here Eliezer ben Hyrcanos and Rabbi Akiba were chief disputants. The former was excommunicated; the latter died about A.D. 135 (in the war of Bar Cochba, whom he believed to be the Messiah). Rabbi Tarphon may be the Tryphon of Justin Martyr. Rabbi Meir drew up a Mishnah, founded on one of Akiba, and itself the basis of that of Jehudah. Simeon ben Jochai was long believed to be the author of the *Zohar*. Rabbi Jehudah the Holy, or the Prince, is generally called simply Rabbi. These are all Tannaim.

BIBLIOGRAPHY: The *Babylonian Talmud* was printed for the first time in Vienna, 1520–3; the censored edition, Basel, 1578–81, omits passages offensive to Christians. Other editions followed, the last being that of L. Goldschmidt, Berlin, 1897 ff. There is an English translation by Rodkinson, Boston, 1901 ff. The Mishnah, text and Latin translation, was published by Surenhusius, Amsterdam, 1698–1703. The last edition is that of Beer, Holtzmann, and others (text with vowels, translation, and notes), Giessen, 1912 ff. Separate Tractates have been edited (some with Gemara) or translated by De Sola and Raphall (eighteen tractates), London, 1845; Strack (*Yoma*, &c., Berlin, 1888); Taylor, *Sayings of the Jewish Fathers*, Cambridge, 1897; Streane, *Chagigah*, Cambridge, 1891; Danby, *Sanhedrin*, London, 1919. The *Jerusalem Talmud*, first published in Vienna about 1523, has been translated into French by Schwab, Paris, 1871. The text of its Mishnah has been edited by Lowe, Cambridge, 1888. The best introduction to the *Talmud* is that of Strack, *Einleitung in den Talmud*, 5th edition, including Midrash, Leipzig, 1921. An article by Emanuel Deutsch, first published in the *Quarterly Review* in 1867, did much to rekindle interest in the *Talmud* in this country. Much interesting matter concerning the early rabbis will be found in Edersheim's *History of the Jewish Nation*, 2nd edition, London, 1896.

Tamarica'ceæ, a small natural order of polypetalous dicotyledons. The species are either shrubs or herbs, inhabiting chiefly the basin of the Mediterranean. They have minute alternate simple leaves and usually small white or pink flowers in terminal spikes. They are all more or less astringent, and their ashes after burning are remarkable for possessing a large quantity of sulphate of soda. See *Tamarisk*.

Tam'arin, the name of certain South American monkeys. The tamarins are active, restless, and irritable little creatures, two of the smallest being the silky tamarin (*Midas rosalia*) and the little lion monkey (*M. leoninus*), the latter of which, though only a few inches in length, presents a wonderful resemblance to the lion.

Tam'arind (*Tamarindus indica*), a large and beautiful tree of the East and West Indies, nat. ord. Leguminosæ. It is cultivated chiefly for the sake of its pods (tamarinds). The West Indian tamarinds are put into casks, with layers of sugar between them, or with boiling syrup poured over them, and are called prepared tamarinds. The East Indian tamarinds are preserved without sugar. They are dried in the sun, or artificially with salt added.


Tamarind

Tam'arisk, the common name of shrubs of the genus Tamarix, the type of the nat. ord. Tamaricaceæ. *T. gallica* is very abundant all round the Mediterranean, and is naturalized on some parts of the south coast of England. It attains a height of from 16 to 20 feet, has small flowers of a bright-rose colour, and altogether has a very attractive appearance, which makes it very much sought after as an ornament for shrubberies and parks.

Tam'atave, the chief port on the eastern side of Madagascar. Pop. 15,000.

Tamaulipas (tà-mou-lē'pàs), a maritime state of Mexico, on the Gulf of Mexico, north of Vera Cruz; area, 80,831 sq. miles. The coast is low, but in the interior, towards the south, the surface becomes finely diversified by mountain, hill, and valley. The soil is generally fertile. Cattle in vast numbers are reared on the pastures.

The foreign trade is carried on chiefly at the ports of Tampico and Matamoros. The capital is Ciudad Victoria. Pop. 249,640.

Tambourine (tam-bų-rēn′), a musical instrument of the drum species, much used among the Spanish and Italian peasants as well as elsewhere. It consists of a piece of parchment stretched over the top of a broad hoop, which is furnished with little bells. It is sounded by sliding the fingers along the parchment, or by striking it with the back of the hand or with the fist or the elbow.

Tambov, a former government of Russia; area, 26,000 sq. miles. Vast numbers of excellent horses, cattle, and sheep are reared. Industrial establishments include distilleries, tallow-melting works, sugar-works, and woollen-mills. Pop. 3,400,000.

Tamil, one of the Dravidian languages, the name being sometimes erroneously extended to denominate the entire family. From a literary standpoint it is the chief of the Dravidian speeches, and is spoken by about seventeen million people occupying that region of the Indian Peninsula between Pulicat, a few miles north of Madras, and Cape Comorin, and between the Bay of Bengal and the Eastern Ghats. Throughout Ceylon the coolies are Tamilians, and the Tamilians generally are the most enterprising and least scrupulous of all Hindus, settling in swarms wherever money is to be made. The *Klings* of the Straits Settlements, and the East generally, are Tamilians. *Malayālam*, spoken within a small area on the west (Malabar) coast of India, south of Mangalore, is very closely allied to Tamil. *Tulu* is used in and around Mangalore. *Kanarese* is used in Mysore and in the western region of Haidarabad.

Tammany Hall, New York, is the headquarters of a powerful section of the Democratic party. In 1789 William Mooney founded the Society of St. Tammany, a benevolent institution named after a well-known Delaware Indian chief. From this society sprang the Tammany Hall General Committee, which, though not representative of the best of the Democratic party, soon attained great power. Aaron Burr became a leading spirit, and secured the return of Jefferson as President of the United States. In 1870 Tammany Hall fell under the evil sway of the notorious Tweed, an early Democratic 'boss'. Tweed initiated a daring system of plunder, which in two years trebled New York's city debt, and proceeded to levy blackmail on prominent and wealthy firms and citizens. At length Tweed fell, betrayed by a dissatisfied participant in the spoil; but Tammany flourished later under John Kelly and Richard Croker, and is still a byword of American political and civic corruption.—Cf. Gustavus Myers, *History of Tammany Hall* (New York, 1901).

Tammuz, a proper name occurring in Scripture, but only once, in *Ez.* viii, 14, a deity of Sumerian origin, worshipped in Babylonia. Tammuz was known among the Canaanites as *Adoni*, and is considered as equivalent to the Greek *Adonis*. The chief worship of Adonis among the Phœnicians was at Byblus, whence it was carried to Cyprus and Greece. Adonis has also been identified with Osiris. The death of Tammuz was celebrated by lamentations, his resurrection with frantic rejoicings mingled with the grossest debauchery. This idolatry appears to have been originally symbolical, connected with the death of nature in winter and its revival in spring.

Tampa, a city of Florida, United States, the county seat of Hillsboro county, on a branch of the Tampa Bay inlet of the Gulf of Mexico; served by the Seaboard Air Line, &c. It is a seaport of importance, a jumping-off point for trade with the West Indies, and is also a seaside-resort. Pop. (1920), 51,608.

Tampi′co, a seaport-city of Tamaulipas state, Mexico, at the mouth of the Panuco. There are important exports. Pop. 35,000.

Tamworth, a municipal borough and market town of England, partly in Warwickshire and partly in Staffordshire. The castle, now modernized, was an important fortress for many years after the Conquest, and the church of St. Editha (1345) was originally founded in the eighth century. Pop. (1921), 8000.

Scarlet Tanager (*Pyranga rubra*)

Tan′agers (Tanagridæ), an American family of perching birds, closely resembling finches, and generally brilliantly coloured. They are mostly natives of South America, but the scarlet tanager (*Pyranga rubra*) and summer red bird (*P. æstiva*) range north to Canada.

Tancred, son of the Marquis Otho the Good and Emma, the sister of Robert Guiscard, born 1078, died 1112. He was one of the heroes of the First Crusade. He distinguished himself at the siege of Nicæa (1097), at the battle of Dorylæum (July, 1097), at the capture of Jerusalem (July, 1099), and at Ascalon (12th Aug.), and was appointed by Godfrey de Bouillon Prince of Galilee. He died of a wound received at Antioch, and is represented by Tasso in his *Jerusalem Delivered* as the flower and pattern of chivalry.

Tanganyi'ka, a lake of Central Africa, lying to the south of Lake Albert and occupying part of the floor of the Great Rift Valley. It is 420 miles long, has an average breadth of about 30 miles, and is 2550 feet above sea-level. It discharges intermittently by the River Lukuga into the Congo. Tanganyika was discovered by Speke and Burton in 1858.

Tanganyika Territory, an East African mandatory territory, comprising portions of the former colony of German East Africa, administered by Great Britain under Article 23 of Part I, Treaty of Versailles.

Area and Population.—The old divisions of Ruanda and Urundi in the extreme north-west, and the tiny region south of the Rovuma River centring on Kionga (the Kionga triangle) are incorporated in the Belgian Congo and Portuguese East Africa respectively. There are twenty-two districts in the territory, viz. Tanga, Pangani, Bagamoyo, Dar-es-Salaam, Rufiji (Utete), Kilwa, Lindi, Rungwe (Tukuyu), Ufipa (Kasanga), Ujiji (Kigoma), Bukoba, Mwanza, Arusha, Moshi, Usambara (Lusheto), Tabora, Kondoa-Irangi, Dodoma, Morogoro, Iringa, Mahenge. (Names in parentheses are district capitals, which, if not specified, are named the same as the respective districts.) Area, about 365,000 sq. miles; pop. (approximately), 4,000,000. See *Urundi and Ruanda.*

Physiography.—There is a coast-line of 500 miles between the Umba River (north) and the Rovuma. From the coastal plain the country rises to the plateau (about 4000 feet altitude) of the hinterland, and this plateau is cleft by the Great Rift Valley, and descends abruptly to the surface-level of Lakes Tanganyika (2590 feet) and Nyasa (1600 feet), which lie within it. The north-eastern corner of Lake Nyasa, part of Lake Tanganyika, and the southern portion of Lake Victoria are within the territory, which includes also Mount Kilimanjaro, Mount Meru (14,960 feet altitude), and the Livingstone Mountains. Rivers are numerous, and many small lakes exist.

Climate.—On the coastal plain the mean annual temperature is 78° F. Several climatic types exist: (1) the Indian, hottest in November, with a December-April wet season; (2) the monsoon type in the north-east, hottest in February, with March-May and November as wet seasons; and (3) the equatorial type prevalent in the north-west, with October-May and November-April as wet seasons, according to locality.

Towns.—Dar-es-Salaam is the capital, and Tanga second in importance. Other seaports include: Bagamoyo, Kilwa, Pangani, and Lindi. Tabora is the chief inland town. Mwanza and Bukoba, on Victoria; Kigoma, Kasanga, and Ujiji, on Tanganyika; and Mwaya, on Nyasa, are the chief lake-side towns.

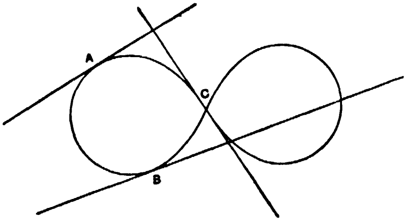
Communications.—There are two metre-gauge railways: (1) Central Railway, from Dar-es-Salaam to Kigoma (Lake Tanganyika); length, 780 miles. (2) Tanga Railway, from Tanga to Moshi; length, 222 miles, with an extension to Kahe affording communication with the Uganda Railway at Voi (Kenya Colony). Motor roads are few. Steamers ply on the three great lakes.

People.—The Swahili is the most important native race; it is mainly Bantu, although there are Masai in the north and people of Zulu descent in the south. On the coastal plain there are some 250,000 Mahommedans, but otherwise paganism is universal. About 10,000 Indians, 4000 Arabs, and 2450 Europeans compose the exotic element. Educational reconstruction began in 1919, and there are about forty-five Government schools. Protestant and Roman Catholic missionaries are at work. The Indian rupee, formerly legal tender, has been demonetized, and a new currency of shillings (20 = £1) has been adopted.

Production.—Sisal, cotton, hides and skins, coffee, copra, ground-nut, ghee, grain, sesame, and bees-wax are the chief exports. Vast plantations of Ceara rubber have failed. In the forests of the Lake Victoria littoral and elsewhere the cedar, ebony, bamboo, &c., are found. Of known minerals, mica has been exploited; gold, coal, iron, lead, copper, salt, and gems (agate, tourmaline, &c.) are known to exist. Cattle, sheep, and goats are raised in large numbers.

Government, &c.—Tanganyika Territory was conquered by British arms during the European War (q.v.: *War in Germany's Colonies*, with map of German East Africa). A provisional civil administration (British) was established north of the Central Railway on 1st Jan., 1917, and was extended in March, 1918, as far south as the Rovuma River. The *Tanganyika* Order-in-Council was proclaimed at Dar-es-Salaam on 25th Sept., 1920, and a Governor with a nominated Executive Council now administers the Territory.

Tangent, in geometry, a straight line which *touches* a curve. If the curve is a circle or a conic, a sufficient definition (Euclid's) is that a tangent is a line which meets the curve, but being produced does not cut it. The tangent to a circle or conic at a given point may therefore be described as the line which passes through the point and has the same direction as the curve at the point; and it is this property, stated in more precise form, which is taken as the general definition applicable to all curves. The straight lines shown in the figure are the tangents to the figure of eight at A, B, and C respectively; but the tangent at A is the only one of the three which satisfies Euclid's definition. The modern definition of a tangent involves the conception of a *limit*, and may be put briefly as follows. Let P be a point on a curve; take Q any neighbouring point, and join PQ, producing it indefinitely; the line PQ is called a *secant* through P. If the point Q is brought closer and closer to P, so that the distance PQ tends to zero (becomes indefinitely small), the secant PQ may tend to a *limiting position*, in which case this limiting position is defined to be the tangent at P. If the curve is defined analytically, its equation being $y = f(x)$, the definition leads to the result that the gradient of the tangent at (x, y) is dy/dx, or $f'(x)$ (see *Calculus*). A curve may have an infinite number of maxima and minima near a particular point, and have no definite tangent at that point; an example is the curve $y = x^2\sin(1/x)$, at the origin. There are even continuous curves which have no tangent anywhere, being, as it were, like the edge of a saw with infinitely many infinitely short teeth; an example is a curve defined analytically by Weierstrass (see *Function*). In geometry of three dimensions, a surface has not only tangent lines, but also *tangent planes*, the tangent plane at an ordinary point of a surface being a plane containing all the tangent lines at that point.



Tanghin (*Tanghinia venenifera*), a tree of Madagascar, nat. ord. Apocynaceæ, bearing a fruit the kernel of which, about the size of an almond, is highly poisonous. Trial by tanghin was formerly used in Madagascar as a test of the guilt or innocence of a suspected criminal. The person undergoing the ordeal was required to swallow a small portion of the kernel. If his stomach rejected it he was deemed innocent, but if he died, as happened in most cases, he was deemed to have deserved his fate and to have suffered the punishment of his crime.

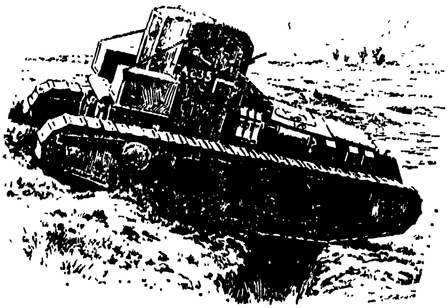
Tangier (tan′jēr), a seaport of Morocco, on the Strait of Gibraltar. It stands on two heights near a spacious bay. The harbour carries on a large trade, but is mainly an open roadstead, although there is a basin for smaller vessels. Pop. 50,000 (12,000 being Europeans). In 1662 Tangier was annexed to the English Crown, but in 1684 it was given up. It is now the centre of the circumambient 'internationalized' zone of Tangier; area, 140 sq. miles.

Tangle, the common name of two species of sea-weed found on the shores of Britain, *Laminaria digitāta* and *L. saccharīna*.

Tanistry, a system of succession employed in early Ireland and Scotland by which every chief or king had a recognized 'tanist' or heir-apparent, a male of his near kin (generally a brother), who was elected heir at the time of the inauguration of the new ruler. Succession was hereditary in the family, but elective in the individual. This device was intended to prevent the occurrence of minorities, or more probably (for the doctrine of primogeniture had not yet been accepted in mediæval Europe) to guard against the danger of disputed successions and of claims derived from a descent through females. Tanistry distinguished the Scots from the Picts, who preferred female to male descent. Tanistry was abandoned in favour of succession by primogeniture.

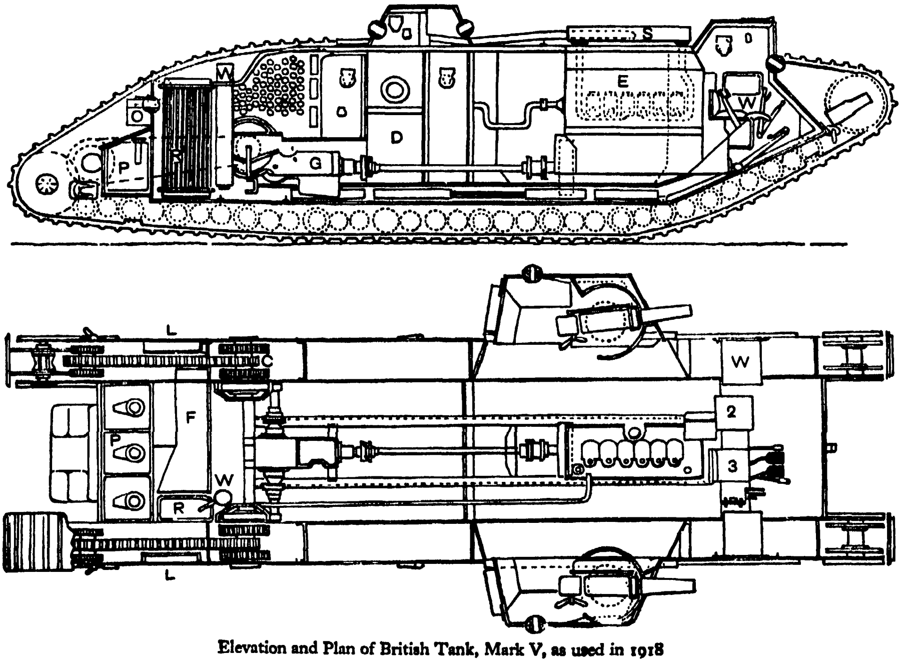
Tanjore, a maritime district and city of Madras province, India. The district, of which more than half forms the delta of the Cauvery, is served by the South Indian Railway, and produces rice as a staple. There are fifteen ports (Negapatam, &c.). Area, 3710 sq. miles; pop. 2,500,000 (91 per cent Hindu). Tanjore City, on the main line of the railway, is the head-quarters. Pop. 60,300.

Tanks. Tanks are the essence of the offensive spirit in modern mechanical warfare, a single tank being in itself a heavily armoured weapon combining mobility with great offensive power. The tank is a great man-power saver, in that a single machine with its crew of from three to eight has the offensive power of many times those numbers of unarmoured infantry soldiers. A well-known writer on tanks, and one with great experience of his subject, sums up the question of the tactical employment of tanks in these three words: "penetration with security". In other words, tanks are used to assist infantry to reach the objective by breaking down the physical obstacles to their doing so, while at the same time using to the full their own great offensive power.


British Tank crossing a Trench

In addition to its rôle of an offensive weapon, the latest pattern of heavy tank of which details have been published can carry from twenty to twenty-five infantry soldiers in addition to its crew; and specially constructed tanks are in use as gun- or supply-carriers. In the first case a 6-inch gun with its ammunition can be carried across country, and in the second case 10 tons of supplies.

The name tank as applied to these machines was, owing to the necessity of camouflage during the experimental period, first used in Dec., 1915, and tanks were first used in battle nine months later, on 15th Sept., 1916, when, out of forty-nine detailed for the attack, thirty-two reached their starting-points. Marvellous as has been their development, tanks are still very much in the experimental stage. From the original Mark I of 1915–6 to Mark V Star of 1918, the latest one to be used in battle, is a far cry, and it is understood that later patterns are still more effective. The original Mark I was fitted with a cumbersome and vulnerable tail as an aid to steering and balancing, both of which operations were performed with difficulty; succeeding Marks have had no tails, and their mechanism has been so much improved that they can turn almost as easily as a light car.



Elevation and Plan of British Tank, Mark V, as used in 1918

P, Petrol tanks. R, Radiator. G, Gear-box. F, Fan. W, Water tank. L, Louvres. C, Driving-chain. E, Engine. S, Silencer. D, Side-door. 2, Gunner's seat. 3, Driver's seat.

Infantry Training 1921 notes that "the speed and radius of action of tanks are constantly increasing". This being so, it is reasonable to assume that the models later than those therein mentioned are possessed of much greater capabilities. The present Mark V, a heavy tank, has a speed of 2½ miles an hour, is armed with two 6-pounders and three Hotchkiss guns, and can cross a 10-foot gap or surmount a parapet 4 feet 6 inches high; it has a crew of eight. Medium C Tank has three Hotchkiss guns, and a speed of 5 miles an hour; it also can negotiate a 10-foot gap, but its climbing powers are limited to a parapet of 3 feet 9 inches; it has a crew of three. It is understood that Medium D has a very much increased speed, even reaching to 20 miles an hour, and has an armament of one 6-pounder and three Hotchkiss guns.—BIBLIOGRAPHY: C. and A. Williams-Ellis, *The Tank Corps*; Colonel J. F. C. Fuller, *Tanks in the Great War*; Captain D. G. Browne, *The Tank in Action*.

Tannahill, Robert, a popular writer of Scottish songs, was born in Paisley in 1774, of parents in humble life, and was himself bred to the occupation of a weaver. In 1807 the first edition of his *Poems and Songs* was published, and was received very favourably by the public. A second edition, carefully revised, which he had prepared for the press, was refused by Constable of Edinburgh, and this tended to increase the melancholy from which he had been suffering; on the 17th of May, 1810, he committed suicide by drowning. Among his songs are: *Gloomy Winter's Noo Awa'*; *Jessie, the Flower o' Dunblane*; *Loudon's Bonnie Woods and Braes*; and *The Lass o' Arranteenie*.

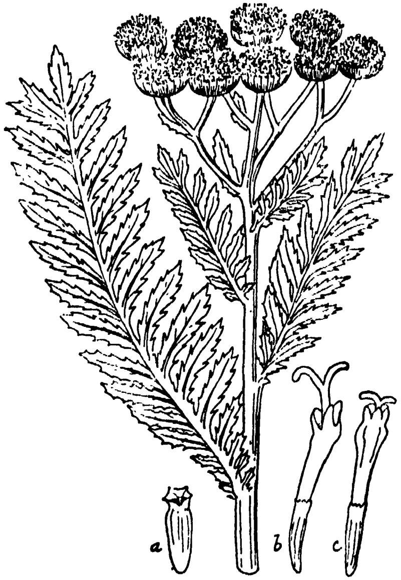
Tannenberg. See *European War (Eastern Front, 1914)*.

Tannhäuser (tăn'hoi-zĕr), or **Tanhäuser**, the hero of an old German legend. He gained admission into a hill called the Venusberg, in the interior of which Venus reigned, and for a long time he remained buried in sensual pleasures. Eventually he escaped and journeyed to Rome, but Pope Urban IV refused to grant him pardon until the staff in his hand should sprout. Despairing, the knight returned to the Venusberg; but meanwhile the Pope's wand actually began to sprout, and, taking this as a sign from God, the Pope hastily sent messengers into all lands to seek for him. But Tannhäuser was never again seen. The Tannhäuser legend has been treated poetically by Tieck and Heine, and Richard Wagner adopted it (with modifications) as the subject of one of his operas. (Cf. also Swinburne's *Laus Veneris.*) The Tannhäuser of the legend was identified with a German knight and minnesinger who lived in the thirteenth century.—Cf. Sabine Baring-Gould, *Curious Myths of the Middle Ages*.

Tannic Acid, or Tannin, a peculiar acid which exists in every part of all species of oaks, especially in the bark, but is found in greatest quantity in gall-nuts. Tannic acid, when pure, is nearly white, and not at all crystalline. It is very soluble in water, and has a most astringent taste, without bitterness. It derives its name from its property of combining with the skins of animals and converting them into leather, or tanning them. It is the active principle in almost all astringent vegetables, and is used in medicine in preference to mineral astringents, because free from irritant and poisonous action. The name is generally applied to a mixture of several substances occurring in plants. All have a characteristic astringent taste, give a blue or green coloration with ferric salts, are precipitated by albumen or gelatine, and react with skin to give leather.

Tanning. See *Leather*.

Tanrec, or Tenrec (Centētes), a genus of insectivorous mammals covered with bristles about an inch in length. They are the type of a special family (Centetidæ) only represented in Madagascar. They hibernate like the European hedgehogs, and live in burrows, which they excavate by means of their strong claws.



Tansy (*Tanacētum vulgāre*)

a, Achene. *b* Tubular ray floret ♀. *c*, Tubular disc floret ⚥.

Tansy (*Tanacētum vulgāre*) is a well-known plant, being abundant in Britain and throughout

Europe on the borders of fields and road-sides. It is a tall plant, with divided leaves and button-like heads of yellow flowers. Every part of the plant is bitter, and it is regarded as tonic and anthelmintic, tansy-tea being an old popular medicine. It is now cultivated in gardens mainly for the young leaves, which are shredded down and employed to flavour puddings, cakes, &c.

Tanta, a town of Lower Egypt. Tanta has three great annual fairs (January, April, and August). Pop. 74,200.

Tan'talite, a heavy mineral tantalate of iron and manganese resembling columbite (q.v.), and used as an ore of tantalum.

Tan'talum, a rare metallic element discovered in the Swedish minerals tantalite and yttrotantalite; chemical symbol, Ta; atomic weight, 181·5. It was long believed to be identical with *niobium*, but their separate identity has been established.

Tan'talus, in Greek mythology, a son of Zeus, and King of Phrygia, Lydia, Argos or Corinth, who was admitted to the table of the gods, but who had forfeited their favour either by betraying their secrets, stealing ambrosia from heaven, or presenting to them his murdered son Pelops as food. His punishment consisted in being placed in a lake whose waters receded from his lips when he attempted to drink, and of being tempted by delicious fruit overhead which withdrew when he attempted to eat. Moreover, a huge rock for ever threatened to fall and crush him.

Tantalus, a genus of wading birds of the stork family (Ciconiidæ). *T. loculator* is the wood-ibis of America, which frequents extensive swamps, where it feeds on serpents, young alligators, frogs, and other reptiles. The African tantalus (*T. ibis*) was long regarded as the ancient Egyptian ibis, but it is rare in Egypt, belonging chiefly to Senegal, and is much larger than the true ibis. Other species are native to South and South-East Asia.

Tantras, sacred books of the Hindus, related to the *Puranas*. They are believed to have been composed in the sixth or seventh century, and are attributed to Dattatreya, who was the incarnation of the Hindu trinity, Brahma, Vishnu, and Siva. The teaching of the *Tantras* is usually in the form of a dialogue between Siva and Durga. The *Tantras* are magical and mystical in their contents, but discuss a variety of subjects, dealing with the creation and destruction of the world, and the worship of the gods.

Taoism, one of the three 'Teachings', or doctrinal systems of China, ascribed to Lao-Tse (q.v.). The source of this philosophical and politico-ethical system is the *Tao-tih-king*, supposed to have been written by Lao-Tse. Taoism teaches a philosophy of the unconscious, self-abnegation and disinterestedness, cultivation of humility and quietism, avoidance of self-display, and non-interference with the natural order of things. Politically it preaches a theory of *laisser-faire*. The chief exponents of Taoism were Chwang-tse in the fourth, and Lieh-tse in the third century B.C. Present-day Taoism, however, differs widely from the teaching of the *Tao-tih-king*. It is a mass of magic and superstition. Between the third and sixth centuries Taoism was greatly influenced by Buddhism.—BIBLIOGRAPHY: J. Legge, *Religions of China*; R. K. Douglas, *Confucianism and Taouism.*

Taormi'na, a famous modern winter seaside-resort, in the province of Messina, Sicily. Pop. 5000.

Ta'pestry, a decorated stuff used chiefly for curtains, wall hangings, and furniture coverings, made by weaving coloured threads into warp threads without a loom or shuttle. The warp threads may either be stretched in vertical frames (high warp or *haute lisse*, the method of the Gobelins factory) or in horizontal frames (low warp or *basse lisse*, the method used at Beauvais). In both cases the weaver works from a design known as a *cartoon*, and a similar result is obtained. The process was practised at a very early period. Examples survive from ancient Egypt and Greece, also numerous specimens of Egypto-Roman work of the second to the fifth century A.D.; and to-day it is widespread in primitive societies. From the fifth to the ninth century the Roman tradition was mainly preserved in the monasteries; but guilds of weavers appeared later, and the art became important and widespread by the end of the thirteenth century. Its chief centres were in Northern Europe, notably at Arras in the fourteenth and fifteenth centuries, Brussels in the fifteenth and sixteenth centuries, Middelburg and Delft in the late sixteenth and early seventeenth centuries, Mortlake in the seventeenth century, and Paris from the sixteenth century to the present day. Climate there made tapestry more suitable for the decoration of ecclesiastical and civil buildings and of private houses than the wall paintings of Italy and the south. Liberal encouragement and patronage were given by the rulers of different countries. Cosimo I of Florence established a factory in that city which survived till the eighteenth century; Wolsey and Henry VIII bought the finest Flemish tapestry of their day, of which many examples still remain at Hampton Court; in France, Francis I, Henry II, and Henry IV all established factories, and Louis XIV founded those of Beauvais and Gobelins, which are still in operation; and in England, James I and Charles I gave liberal support to the Mortlake factory. Private enterprise in the eighteenth and nineteenth centuries is represented by the existing factory at Aubusson, and the work in England of Hickes, of the Fulham factory, and of William Morris. The cartoons of the earlier tapestry weavers were mainly derived from mural decorations and illuminated manuscripts, and in subject and design show markedly the influence of painting. In the fifteenth and sixteenth centuries, however, more purely decorative pieces are woven, such as the leafy designs known as *verdures*, and those embodying heraldic or pure abstract ornament. The borders enclosing the designs also show an interesting development, from a simple selvage or plain band, through narrow borders enclosing legends in Gothic letter, or composed of floral patterns, to the heavy and elaborate ornament of the seventeenth and eighteenth centuries. Among painters who have supplied designs for tapestry are: Jehan Fouquet (a set illustrating the Trojan War, woven at Arras in the fifteenth century, represented in the Victoria and Albert Museum), Raphael (the famous cartoons of the *Acts of the Apostles*, in the Victoria and Albert Museum), Rubens, Bernard van Orley, Le Brun, Boucher, and Oudry. With the change in painting from the use of colour in a mosaic of definite tints, to its treatment as modified by light and shade and atmosphere, corresponds the more realistic treatment of the seventeenth century and subsequent tapestries, in which there is not only a much wider range of colour but greater complexity and subtlety in weaving. This approximation of tapestry and painting culminates in the productions of Gobelins and Beauvais under the control of the painters Oudry and Boucher, the former factory concentrating mainly on wall hangings, the latter on furniture coverings, screens, and small panels. The result has been virtually to kill tapestry as an independent art, by causing it to lose its own characteristic qualities in attempting to imitate and rival painting.—Cf. W. G. Thomson, *A History of Tapestry.*

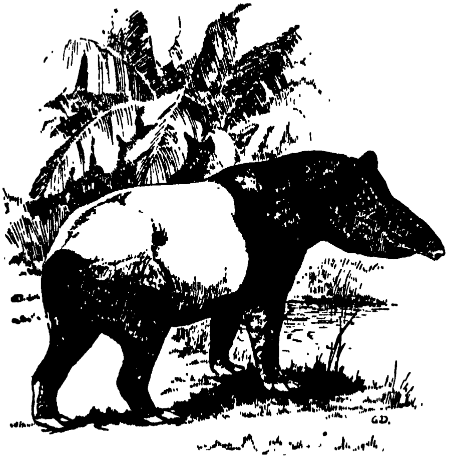
Tap'eti, the Brazilian hare, the *Lepus brasiliensis*, the only hare inhabiting South America.

Tape-worms, the name common to certain internal parasites, constituting the class Cestoda of the phylum Platyhelmia, found in the mature state in the alimentary canal of warm-blooded vertebrates. Tape-worms are composed of a number of flattened joints (proglottides), attached to a head (which is the true animal) furnished with hooks or suckers, or both, which enable it to maintain its hold on the mucous membrane of the intestines of its host. The proglottides form a chain of bisexual buds, the oldest being farthest removed from it. The tape-worm has neither mouth nor digestive organs, nutrition being effected by absorption through the skin. The length of the animal varies from a few inches to several yards. The ova do not undergo development in the animal in which the adult exists. They require to be swallowed by some other form, usually a warm-blooded vertebrate, the ripe proglottides being expelled from the bowel of the host with all their contained ova fertilized. The segments or proglottides decompose and liberate the ova, which are covered with a capsule. After being swallowed the capsule bursts and an embryo, called a *proscolex*, is liberated. This embryo, by means of spines, perforates the tissues of some contiguous organ, or of a blood-vessel, in the latter case being carried by the blood to some solid part of the body, as the liver or brain, where it surrounds itself with a cyst, and develops a vesicle containing a fluid. It is now called a bladder-worm, which is incapable of further development till swallowed by the second or intermediate host. Here it becomes the head of the true tape-worm, from which proglottides are developed posteriorly by gemmation, and we have the adult animal with which the cycle begins. Several true tapeworms occur in man, *Tænia solium*, the cystic form of which (*Cysticercus cellulosæ*) produces the measles of the pig, being the most common. Another, *T. mediocanellata*, is developed from the bladder-worm, which causes measles in the ox. The tape-worm of the dog, *T. serrāta*, is the adult form of the large bladder-worm (*Cœnurus cerebralis*) which infests the brain of the sheep, causing staggers. Each cyst produces a number of tape-worms. *T. echinococcus* of the dog passes its bladder-worm stage in man, or a hoofed mammal, as a huge compound cyst (*Echinococcus veterinorum*), from which numerous tape-worms may develop.

Taphrina, a genus of ascomycetous Fungi, family Exoascaceæ. They are parasites producing blister-like malformations on the leaves of pear, poplar, elm, and other trees.

Tapio'ca, a farinaceous substance prepared from cassava meal, which, while moist or damp, has been heated for the purpose of drying it on hot plates. By this treatment the starch-grains swell, many of them burst, and the whole agglomerates in small irregular masses or lumps. In boiling water it swells up and forms a viscous jelly-like mass. See *Cassava.*

Tapir, the name of odd-toed ungulate or hoofed mammals forming the family Tapiridæ. The nose resembles a short fleshy proboscis; there are four toes to the fore-feet, and three to the hind ones. The common South American tapir (*Tapirus terrestris*) is the size of a small ass, with a brown skin, nearly naked. It inhabits forests, lives much in the water, conceals itself during the day, and feeds on vegetable substances. There are several other American species. The *T. indicus* is found in the forests of the Malay Peninsula, Java, and Sumatra. It is larger than the American species, and is a most conspicuous animal from the white back, rump, and belly contrasting so strongly with the deep sooty black of the rest of the body as, at a little distance, to give it the aspect of being muffled up in a white sheet. The young are spotted. Fossil tapirs are scattered throughout Europe, Asia, and North America.



Tapir (*Tapirus indicus*)

Tapping, or **Paracente′sis**, a surgical operation commonly performed for dropsy, but also for empyema, and for the relief of other morbid effusions in natural or accidental cavities of the body. It consists in piercing the wall of the cavity with an instrument, commonly a trocar or a bistoury. The fluid usually flows out, but it is sometimes necessary to use an instrument which acts as a syringe.

Tar. See *Coal-tar*; *Gas Manufacture*; *Pitch*; *Retort*; *Wood-tar*.

Tara, or **Taro**, the native name given to plants of the genus Colocasia, nat. ord. Araceæ, especially *C. esculenta* and *C. macrorhiza*, cultivated in the Pacific Islands for their esculent root, which, though pungent and acrid when raw, becomes palatable when cooked. A pleasant flour is also made of the roots or tubers, and the leaves are used as spinach. The name is also given to the allied *Caladium esculenta*, whose tuberous root and leaves are used in the same manner.

Tara, a hill (510 feet altitude) of County Meath, Ireland, the centre of Druidism in the time of St. Patrick, and for long a residence of the kings of Ireland.

Tarai (ta-rī′; 'moist land'), a marshy and jungly tract of Northern India, running along the foot of the first range of the Himálaya for several hundred miles, with a breadth of from 2 to 15 miles. The name is officially applied to a district in the Kumaun division of the United Provinces, consisting of a strip of country of about 90 miles in length along the foot of the Himálaya, and about 12 miles in breadth; now comprised in the Naini Tal district. Both are malarial and frequented by big game.

Tarana′ki (formerly **New Plymouth**), a provincial district of New Zealand, on the west coast of North Island; area, 3782 sq. miles. It is dominated by Mount Egmont, an extinct volcano. Dairying is the chief industry. New Plymouth is the chief town and port. Pop. 61,900.

Taran′to (ancient **Tarentum**), a seaport of Apulia, South Italy, in the province of Lecce, on the Gulf of Taranto. Manufactures include linen, cotton, velvet, muslin, and gloves. Taranto is a station of the Italian navy, and has an arsenal, &c. The ancient *Tarentum* was founded by the Greeks in 708 B.C., and became a powerful city. It was captured by the Romans (272 B.C.), and remained a notable Roman town until the downfall of the Empire. Pop. 50,000.

Taran′tula, a kind of spider, the *Lycŏsa tarantŭla*, found in some of the warmer parts of Italy. When full grown it is about the size of a chestnut, and is of a brown colour. Its bite was at one time supposed to be dangerous, and to cause a kind of dancing disease; it is now known not to be worse than the sting of a common wasp.

Tarapacá, a maritime province of Northern Chile. It forms a part of the rainless desert which produces nitrate of soda, and some silver. Iquique is the seaport-capital; other ports are Pisagua and Patillos. Area, 16,689 sq. miles; pop. (1920), 100,553.

Tarare (tá-rär), a town of France, in the department of Rhône. It has manufactures of muslins, silks, velvets, &c. Pop. 13,000.

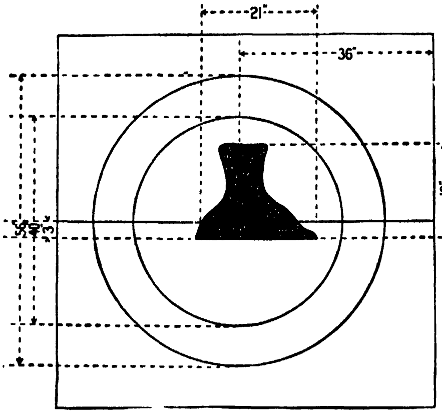
Tarascon, a town of Southern France, in the department of Bouches-du-Rhône, on the Rhône. The placidity of its daily routine is satirized by Daudet (*Tartarin de Tarascon*). Pop. 9000.

Tarbes (tárb), a town of France, capital of the department of Hautes Pyrénées, on the Adour; served by the Southern Railway. Manufactures embrace leather, woollens, machinery, weapons, &c. There is a race-course (Laloubère), and a breed of horses is raised. Pop. 28,615.

Tare, the common name of different species of Vicia, a genus of leguminous plants, known also by the name of *vetch*. There are numerous species and varieties of tares or vetches, but that which is found best adapted for agricultural purposes is the common tare (*Vicia sativa*), of which there are two principal varieties, the summer and winter tare. They afford excellent food for horses and cattle, and hence are extensively cultivated throughout Europe. (See *Vetch.*) The *tare* mentioned in Scripture (*Matt.* xiii, 36) is supposed to be the *Lolium temulentum* or darnel (q.v.).

Tare, in commerce, a deduction made from the gross weight of goods as equivalent to the real or approximate weight of the cask, box, bag, or other package containing them. Tare is said to be *real* when the true weight of the package is known and allowed for, *average* when it is estimated from similar known cases, and *customary* when a uniform rate is deducted. In the phrase *tare and tret*, the word *tret* signifies an allowance for waste.

Target, formerly used to describe the small shield carried by a foot soldier; now used almost entirely to denote a mark to aim at, more particularly with regard to rifle-fire. In this connection targets are of many kinds, shapes, and sizes, though the basic construction of all is the same, i.e. all are made of a framework of wood, over which is stretched a sheet of canvas, on which is painted either a 'bull's-eye' or other mark to aim at, the remaining space being divided by invisible concentric circles, hits in which count less than in the bull's-eye; other targets have figures representing a man in various positions.



First-class Figure Target

Târgu Jiu (töirgu zhyu), a town of Wallachia, Roumania, capital of the department of Gorjiu, on the Jiu, one of the chief Wallachian rivers; the terminus of the State railway from Filiasi. Standing at the entrance to the gorge of the Jiu, the town owes its importance to its position at the head of a route across the Transylvanian Alps, and as such it figured prominently during the European War. The Roumanians were driven out of Târgu Jiu on 15th Nov., 1916, after a struggle lasting from 23rd Oct. almost without cessation, during the first phase of which the Germans under Falkenhayn were driven back in utter disorder, and were pursued until 1st Nov. The second phase began on 10th Nov. Dragalina, the Roumanian general, was killed during the first battle.

Targum (Aram. *targum*, translation, from *targem*, to interpret), a version of the Hebrew Scriptures in the Aramaic language, which became necessary after the Babylonian captivity, when Hebrew began to die out as the popular language. An official, called *meturgeman*, had to translate the Hebrew Scriptures in the synagogues, and these translations were afterwards called *Targum*. The *Targum*, long preserved by oral transmission, does not seem to have been committed to writing until the first centuries of the Christian era. The most ancient and valuable of the extant *Targums* are those ascribed to or called after Onkelos (q.v.) and Jonathan Ben Uzziel. All the *Targums* taken together form a paraphrase of the whole of the Old Testament, except *Nehemiah*, *Ezra*, and *Daniel*.

Tari'fa, a seaport of Andalusia, Spain, in the province of Cadiz, the most southerly town in Europe. It is quadrangular in build, and protected by a fortified islet. Fishing is the staple industry. Tarifa oranges are noted for their sweetness. Pop. 12,500.

Tariff Reform. See *Free Trade*; *Protection*.

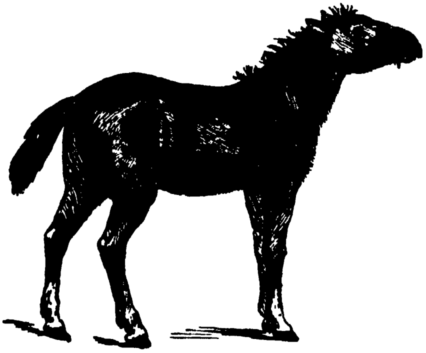
Tarn, a department of South-Western France; area, 2218 sq. miles. Cereals and vines are cultivated on the tops and sides of the flat-topped hills. The capital is Albi. Pop. 295,588.

Tarn-et-Garonne, a department of South-Western France; area, 1436 sq. miles. It belongs to the basin of the Garonne, which traverses it south to north-west, and receives within it the accumulated waters of the Tarn (length, 230 miles) and Aveyron. Wheat and other cereals, fruit, &c., are raised. Woollen cloth and serge, linen goods, silk hosiery, cutlery, leather, &c., are made. Montauban is the capital. Pop. 159,560.

Tarnopol', a town of Poland, in Galicia, on the Sereth. The inhabitants are employed in corn-milling and trading in agricultural produce. Pop. 34,000.

Tarnov, a town of Poland, in Galicia, on the Biala. It has manufactures of linen, leather, chicory, and glass. Pop. 37,000.

Tarpan, the wild horse once abundant in the steppe region between the Dnieper and Caspian, belonging to one of those races which are by some authorities regarded as original. They are not larger than an ordinary mule. The colour is invariably tan or mouse, with black mane and tail. During the cold season their hair is long and soft, but in summer it falls much away. A similar type exists in the Gobi Desert and its neighbourhood.


Tarpan

Tarpau'lin, canvas well coated with tar, and used to cover the hatchways, boats, &c., on shipboard, and also to protect agricultural produce, goods in transit, &c., from the effects of the weather. In modern times so-called tarpaulin-cloth is extensively made from jute yarns, and delivered untarred to be used for the abovementioned purposes.

Tarpeian Rock, a precipitous rock forming part of the Capitoline Hill at Rome over which persons convicted of treason to the State were hurled. It was so named, according to tradition, from *Tarpeia*, a vestal virgin of Rome, and daughter of the governor of the citadel on the Capitoline, who, covetous of the golden bracelets worn by the Sabine soldiery, opened the gate to them on the promise of receiving what they wore on their left arms. Once inside the gate they threw their shields upon her, instead of the bracelets. She was buried at the base of the Tarpeian Rock.

Tarpon, or Tarpum, the *Megalops atlanticus*, a herring-shaped fish found on the southern coasts of the United States and in the West Indies. It reaches a length of 5 or 6 feet, and is from a hundred to several hundred pounds in weight. It is of giant strength. Though too coarse ordinarily for food, it is a great attraction to anglers. Its scales, which are of great size, are largely used in ornamental work.

Tarquinius, Lucius, surnamed *Priscus* (the first or the elder), in Roman tradition the fifth King of Rome, supposed to have reigned from 616–578 B.C. The family of Tarquinius was said to have been of Greek extraction, his father, Demaratus, being a Corinthian who settled in Tarquinii, one of the chief cities of Etruria. Having removed with a large following to Rome, Tarquinius became the favourite and confidant of the Roman king, Ancus Martius, and at his death was unanimously elected his successor. According to Livy, he made war with success on the Latins and Sabines, from whom he took numerous towns. His reign was distinguished by the construction of the Cloaca Maxima, the Forum, the wall round the city, and the Capitoline Temple. He was killed by assassins employed by the sons of Ancus Martius in 578 B.C.

Tarquinius, Lucius, surnamed *Superbus* (the proud), the last of the legendary kings of Rome, the son of Lucius Tarquinius Priscus, reigned from 534–510 B.C. He abolished the privileges conferred on the plebeians; banished or put to death the senators whom he suspected, never filled up the vacancies in the senate, and rarely consulted that body. He continued the great works of his father, and advanced the power of Rome abroad both by wars and alliances. By the marriage of his daughter with Octavius Mamilius of Tusculum, the most powerful of the Latin chiefs, and other political measures, he caused himself to be recognized as the head of the Latin confederacy. In 510 B.C. a conspiracy broke out by which Tarquinius and his family were exiled from Rome, an infamous action of his son Sextus being part of the cause of the outbreak (see *Lucretia*). He tried repeatedly, without success, to regain his power, and at length died at Cumæ in 495 B.C.

Tarragon (*Artemisia Dracuncŭlus*), a strong erect perennial plant of the composite order, a native of Siberia, cultivated in gardens for flavouring dishes.

Tarrago'na, a maritime province of North-Eastern Spain. It is traversed by the Ebro in the south, and, although mountainous, is agriculturally rich, viticulture being prominent, and all kinds of cereals, &c., being raised. Manufactures include silks, velvets, soap, leather, and spirits, and fisheries are notable. Tarragona is the capital. Area, 2505 sq. miles; pop. 329,080.

Tarragona (ancient **Tarraco**), a seaport of Spain, capital of the province of Tarragona, on the Francoli. The town was founded by the Phœnicians, and was long important under the Romans. In its environs are an ancient amphitheatre, a circus, an aqueduct, &c. There is a large number of *bodegas* or wine-cellars. It has a trade in corn, wine, and fruit. Pop. 23,289.

Tarra'sa, an industrial town of Spain, in the province of Barcelona. Manufactures include cottons and woollens. Pop. 22,679.

Tarsia-work (It., from Lat. *interserere*, to insert), a kind of mosaic woodwork or marquetry much in favour in Italy in the fifteenth century. It was executed by inlaying pieces of wood of different colours and shades into panels of walnut-wood, so as to represent landscapes, figures, fruits, flowers, &c. At Sorrento and other places the manufacture of wood-mosaic, in modern times, has become celebrated.

Tarsius, a genus of mammals of the lemur family inhabiting the Eastern Archipelago. In this genus the bones of the tarsus are very much elongated, which give the feet and hands a disproportionate length. *Tarsius spectrum*, the spectre tarsier, seems to be the only species known. It is about the size of a squirrel, fawn-brown in colour, with large ears, large eyes, and a long tufted tail. It is nocturnal in its habits, lives among trees, and feeds upon lizards.

Spectre Tarsier (*Tarsius spectrum*)

Tarsus, in anatomy, that part of the foot which in man is popularly known as the ankle, the front of which is called the instep. It corresponds to the wrist of the upper limb or arm, and is composed of seven bones. (See *Foot.*) In insects the tarsus is the last segment of the leg. It is divided into several joints, the last being generally terminated by a claw, which is sometimes single and sometimes double. In birds the tarsus is that part of the leg (or properly the foot) which extends from the toes to the first joint above; the shank.

Tarsus (modern **Tersous**), an ancient city of Cilicia, Asia Minor. The Apostle Paul was born, and Julian the Apostate was buried there. Its inhabitants enjoyed the privileges of Roman citizens, and the city even became a rival of Athens, Antioch, and Alexandria. Tersous stands on the Cydnus, has a flourishing trade, and is connected by railway with Adana and the port of Mersina.

Tartan, a species of cloth, checkered or cross-barred with threads of various colours. It was originally made of wool or silk, and constituted the distinguishing badge of the Scottish Highland clans, each clan having its own peculiar pattern. An endless variety of fancy tartans is now manufactured, some of wool, others of silk, others of wool and cotton, or of silk and cotton. The tartan patterns are used extensively for the decoration of travelling-rugs; in some cases the cloths are single make and composed of comparatively thick yarns; while in other cases equally thick fabrics are woven from much finer yarns, by double-structure; and in the latter examples the two exterior surfaces of the rug are often adorned with two quite different tartans.

Tartar Emetic, or potassium antimonyl tartrate, $K(SbO)C_4H_4O_6$, is prepared by heating cream of tartar with antimony oxide and water. It crystallizes in small octahedra, and is used medicinally as an emetic.

Tartaric Acid, or dihydroxy-succinic acid, $C_2H_2(OH)_2(COOH)_2$, an important vegetable acid occurring in the juice of the grape and in many fruits associated with malic acid. It is prepared from argol (see *Cream of Tartar*). It crystallizes in large monoclinic prisms soluble in water and alcohol. It has a sour taste, is odourless, and is a dibasic acid. On heating it melts and then decomposes, yielding several compounds. It exists in four stereoisomeric forms, *lævo-tartaric acid, dextro-tartaric acid, meso-tartaric acid,* and *racemic acid,* the first two of which are optically active (see *Stereochemistry*; *Polarization of Light*). Naturally occurring tartaric acid is dextro-rotatory. It is used medicinally, the sodium potassium salt (*Rochelle salt*) forming the basis of Seidlitz powders; to some extent in calico-printing as a discharge; and in certain baking-powders.

Tar'tarus, a deep and sunless abyss, according to Homer and the earlier Greek mythology, as far below Hades (q.v.) as earth is below Heaven. It was closed by iron gates, and in it Zeus imprisoned the rebel Titans. Later poets describe Tartarus as the place in which the spirits of the wicked receive their due punishment; and sometimes the name is used as synonymous with Hades, or the lower world in general.

Tashkent', or **Tashkend'**, a town of Russian

Turkestan, on the Tchirshik, near its confluence with Syr Darya. It is connected by rail with Orenburg. Manufactures include silks, cottons, iron goods, &c., and trade, carried on chiefly by caravans, but partly by railway, is very extensive. Pop. 165,000.

Tasma'nia, an island state, the smallest of the Australian Commonwealth, separated from the continent by Bass Strait (q.v.); area, 26,215 sq. miles (main island, 24,330 sq. miles). There are fifty-five adjacent islands, mostly in Bass Strait. The Furneaux group (with Flinders Island), King's Island, Maria Island (on the east coast), and Bruny Island (south coast), are the chief. (See Table of Comparative Areas, under *Queensland.*) The total population is 211,980.

Physiography.—There is a coast-line of 900 miles (i.e. 29 sq. miles of territory to each mile of coast-line). Cradle Mountain (5069 feet altitude), the Frenchman's Cap (4756 feet), and Ben Lomond (5010 feet) are the chief peaks. Rivers include: the Derwent, Huon, Arthur, and Tamar. The chief lakes are: Great Lake (area, 28,000 acres), Lake Sorell (12,300 acres), and Lake St. Clair (10,000 acres). *Climate.*—Captain Cook described it as " the finest in the world ", and it certainly is exceedingly equable. In December, January, and February, the summer months, the average temperature is 62°, and in winter 47°, or 8° higher than London.

Towns.—Hobart (pop. 53,400) is the capital. Launceston, on the Tamar, has a population of 28,000.

Production.—Wheat, oats, barley, potatoes, pease, beans, and hops are largely cultivated, and the fruit includes grapes, cherries, plums, quinces, mulberries, peaches, apricots, walnuts, filberts, almonds, &c. Apples are exported, one-half of the crop reaching European markets. Ale from Tasmania is in great demand in Australia. Much wool is produced and exported. Other exports are: jam, tanning bark, calcium carbide, timber, wolfram, gold, copper, silver, tin, lead, and zinc. In order of importance the chief mineral products are: copper, tin, argentiferous lead, zinc, osmiridium, coal, gold, and wolfram. The Mount Lyell copper-mine is one of the world's greatest. Much of the island is heavily timbered.

Social Conditions: Religion.—The bulk of the people are Anglican, with Roman Catholics a bad second, and Presbyterians third. *Education.*—There is, at Hobart, a University of Tasmania, granting degrees in arts, science, law, engineering, and commerce. State high schools tend to supplant the older ' secondary ' schools, both public and private. Primary education is free, compulsory, and non-sectarian.

Government.—There is a Central Government with a bicameral legislature. The Legislative Council has 18 members, and the House of Assembly 30, both elected. For local government purposes there are 48 municipalities, besides Hobart and Launceston.

History.—Tasmania was discovered (1642) by Abel Jansen Tasman, who named it after Van Diemen, the Governor of the Dutch East Indies. It was visited by Cook in 1769, and annexed to Britain in 1803, when the first settlement was made as a penal auxiliary to Botany Bay. In 1816 voluntary settlers began to arrive, and, following the separation from Botany Bay (1825) and the arrival of the last convicts (1853), the name Tasmania was adopted and responsible government granted, and in 1901 Tasmania was federated with the other Australian colonies.

Tasmanite, a flaky, resinous, brown coal occurring in Tasmania.

Tasso, Torquato, Italian epic poet, son of Bernardo Tasso (1493–1569), also a poet, born at Sorrento 1544, died 1595. He was early sent to the school of the Jesuits at Naples, and subsequently pursued his studies under his father's superintendence at Rome, Bergamo, Urbino, Pesaro, and Venice. At the age of sixteen he was sent to the University of Padua to study law, but at this time, to the surprise of his friends, he produced the *Rinaldo*, an epic poem in twelve cantos. The reputation of this poem procured for Torquato an invitation to the University of Bologna, which he accepted. Here he displayed an aptitude for philosophy, and began to write his great poem of *Gierusalemme Liberata* (Jerusalem Delivered). While engaged on it he secured a patron in Cardinal Louis d'Este, to whom he had dedicated his *Rinaldo*. He was introduced by the cardinal to the court of Alfonso II of Ferrara. Here he remained from 1565 to 1571, when he accompanied the cardinal on an embassy from the Pope to Charles IX of France. Having quarrelled with his patron, Tasso returned to Ferrara, and in 1573 brought out the *Aminta*, a pastoral, which was represented at the court. In 1575 he completed his epic of *Gierusalemme Liberata*. About this time he became a prey to morbid fancies, believed that he was persistently calumniated at court, and systematically misrepresented to the Inquisition. To such a pass, indeed, had this mania come in 1577 that the poet drew his poignard upon one of the domestics of the Duchess of Urbino. He was immediately arrested, but was set at liberty after two days' confinement. At his own request he returned to Ferrara, to the convent of St. Francis; but from here he made his escape, and travelled in disguise to his native place, Sorrento, where he stayed with his sister Cornelia. He again asked permission to return to Ferrara, a request which the duke coldly granted. But in his excited and jealous condition of mind Tasso found it impossible to re-establish the old friendly relationship at the court. He fled from Ferrara again, but again returned. So outrageous had his conduct now become that he was seized by the duke's orders and confined as a madman in the hospital of St. Anne at Ferrara. Here he remained from 1579 to 1586, until he was released at the solicitation of Vincent di Gonzaga. Broken in health and spirit, he retired to Mantua, and then to Naples. Finally, in 1595, he proceeded to Rome at the request of the Pope, who desired him to be crowned with laurel in the capitol, but the poet died while the preparations for the ceremony were being made. Tasso wrote numerous poems, but his fame rests chiefly on his *Rime*, or lyrical poems, his *Aminta*, and his *Gierusalemme Liberata.* His letters are also interesting.—BIBLIOGRAPHY: Editions—A. Solerti (Florence, 1895–6, 3 vols.). Translations—E. Fairfax; John Hoole. Biographies—R. Milman, *Life of Tasso*; A. Solerti, *Vita di Torquato Tasso*; W. Boulting, *Tasso and his Times.*

Tasso'ni, Alessandro, Italian poet, born 1565, died 1635; chiefly known from his mock-heroic poem *La Secchia Rapita* (The Rape of the Bucket), founded on an incident that gave rise to war between the Modenese and Bolognese in the thirteenth century.

Taste, the sense by which we perceive the relish or savour of a thing. The organs of this special sense are the *papillæ*, or processes on the surface of the tongue, and also certain parts within the cavity of the mouth and the throat, as the soft palate, the tonsils, and the upper part of the pharynx. See *Tongue.*

Tatars, or **Tartars**, the Russian term for the 3 million Turanian, and generally Muslim, tribes of Turkish origin settled within the confines of the former Imperial frontiers. The term Turko-Tatar is used by scholars to designate non-Russian Turks, but is regarded as an insult by the Turks proper, who recognize no such ethnic (anthropological) designation. *Tartar* is derived from the Fr. *Tartare*, a collective term for Turks, Mongols, and Tunguses (and sometimes Finns). According to the Arabic author Abulghazi, a descendant of Turk, one of the eight sons of Japhet, had twin sons, Tatar and Mongol. *Mongol*, however, does not appear in the Chinese annals, and from A.D. 880 onwards *Tata* is common as a name for certain wild hordes of the In-Shan. The term *Tatar* was introduced into Europe by the Russians, and, although only the name of the tribal rearguard of the armies of Jenghiz Khan, it soon was extended to embrace Turks and Mongols collectively.

Tate, Nahum, dramatist, poetaster, and Poet Laureate, was born in 1652, and died in 1715. He was educated at Trinity College, Dublin, where he graduated B.A. in 1672. His first drama, *Brutus of Alba*, founded on the story of Æneas and Dido, appeared in 1678. He then undertook to improve several of Shakespeare's plays, a task for which he was eminently qualified by total lack of poetic and dramatic ability. He metamorphosed *Richard II* into *The Sicilian Usurper*, but even in this camouflaged form the play proved too full of political allusions to suit a Restoration audience, and it was suppressed after three performances. Tate's version of *King Lear* actually secured the banishment of Shakespeare's version from the stage until 1840. Tate cut out the part of the Fool, and made the play end happily with the marriage of Cordelia to Edgar. *Coriolanus* turned into *The Ingratitude of a Commonwealth* in 1682. Tate also improved plays by Fletcher and Webster, and *Eastward Ho!* by Jonson, Chapman, and Marston. Dryden employed him in 1682 to write the second part of *Absalom and Achitophel.* In 1692 he was appointed Poet Laureate; he has strong claims (contested by Pye and Eusden) to be considered the least distinguished holder of that office. In 1696, having finished with Shakespeare, he turned his attention to the *Psalms*; and in that year his *New Version of the Psalms*, written in collaboration with Dr. Nicholas Brady, appeared. This version, though it attained almost universal use, is devoid of all poetic merit.

Tate Gallery, the popular name for the National Gallery of British Art, presented to the nation by Sir Henry Tate, Bart. (1819–99), in 1897, and added to by Sir Joseph Duveen, the new wing being opened in 1910. The Gallery is situated in Millbank, London, and Sir Joseph Duveen has gifted a Gallery of Modern Foreign Art, which will be erected beside it.

Tatian, Christian apologist of the second century. A native of Assyria, he was educated in Greek philosophy; travelled extensively; caused himself to be initiated in the rites of various religions; and eventually embraced Christianity. Tatian became a disciple of Justin, after whose martyrdom he left Rome and journeyed into Mesopotamia, where he preached certain Gnostic and heretical doctrines. He seems to have disbelieved in the divinity of Christ, and his teaching inculcated abstinence from wine, from animal flesh, and from marriage. As a Christian apologist he wrote *Oratio ad Græcos*, which is still extant, and his *Diatessaron* seems to prove the existence of four gospels about the middle of the second century. The Latin version of the latter work was translated into English by Hill.

Tattersall's, Knightsbridge Green, London, is the great metropolitan mart for horses, and head-quarters of the turf; removed in 1685 from Grosvenor Place, where it was established by Richard Tattersall (1724–95) in 1773.

Tattooing denotes the practice of making permanent coloured designs or figures in the skin by means of small punctures or incisions, which receive various dyes or pigments. This method of tattooing is to be distinguished from the custom of scarification, scar-tattooing, or cicatrization, which is practised by the dark-skinned people, and which consists in repeatedly cutting the skin at the same place so that in healing a raised scar is left. The custom of tattooing is found among numerous nations of different degrees of cultural development, as among the aborigines of Australia, the Polynesians, the Ainus of Japan, the old Egyptians, and probably among the Israelites, as may be inferred from the prohibition in *Lev.* xix, 28. Colour tattooing of an ornamental kind reached its most artistic development among the Maoris of New Zealand and the Japanese, but both these nations have almost completely abandoned the practice under the influence of civilization. The origin of tattooing has been ascribed to the custom of making blood-offerings to the departed spirits, to primitive therapeutics, to religious reasons, and especially to a desire of primitive man to beautify his body, and to the motive of sex attraction. As a rule, colour tattooing is generally ornamental, but scar-tattooing is more frequently used to produce distinguishing tribal marks. The practice of colour-tattooing is very prevalent among sailors of all nationalities.

Tauchnitz (tou*h*'nits), Bernhard Christian, Baron, German publisher, born 1816, died 1895. His establishment at Leipzig, founded in 1837, is widely known from the collection of British authors issued from it, which numbers over 4000 volumes, and is continually increasing. Baron Tauchnitz was British Consul-General for Saxony.

Taunton, a municipal borough of Somerset, England, on the Tone. The castle is of very ancient foundation, and now contains an archæological and natural history museum; there are also an old market-house and the Shire Hall. The town was long celebrated for woollens; it now manufactures silks and gloves, has foundries, coach-works, breweries, &c. Taunton is of great antiquity, and was a residence of West Saxon kings. Pop. (1921), 23,219.

Taunton, a city of Massachusetts, United States, one of the county seats of Bristol county, on Taunton River; served by the Old Colony branch of the New York, New Haven, & Hartford Railway. It is a herring-fishery centre, and has varied manufactures and a heavy shipping trade. Pop. 37,140.

Taunus, a mountain range of Western Germany, mainly in Hesse-Nassau, extending eastward from the Rhine, north of the Main; highest summit, Great Feldberg (2886 feet). It contains the mineral springs of Wiesbaden, Homburg, and Nauheim.

Tau'rida, a former government of Imperial Russia; area, 24,497 sq. miles. It contained the Crimea, and was drained by the Dnieper. Cattle-breeding and agriculture were important. Simferopol was the capital. Pop. 1,966,000.

Taurus, the Bull, one of the twelve signs of the zodiac, which the sun enters about the 20th April. Taurus is also the second zodiacal constellation. Its brightest star, of orange colour and of the first magnitude, represents the eye of the Bull, and is named Aldebaran. Close by is the group of stars called the Hyades. The constellation also contains the well-known beautiful cluster of the Pleiades.

Taurus, a mountain chain of Asia Minor, stretching for about 500 miles from the Euphrates to the Ægean Sea, afterwards running north of the Gulf of Adalia. In the east it takes the name of Ala Dagh, in the west that of Bulghar Dagh. It descends steeply to the sea on the south; northwards it merges gradually into the plateau of Asia Minor. It is connected by the Alma-Dagh with the chain of Lebanon; and by Anti-Taurus, with Ararat, Elburz, and the Caucasus.

Tavistock, a market town of Devonshire, England, in the valley of the Tavy. Manganese, copper, silver, tin, and lead are worked near by, and arsenic is produced from the copper ore. Sir Francis Drake was a native. Pop. (1921), 4300.

Tavoy, a district and town in the Tenasserim division of Lower Burmah. The district extends east and west between the Siamese frontier and the Bay of Bengal, and is very rugged, except in the valley of the Tavoy River and along the coastal plain. Rice is the staple crop. The town, on the Tavoy River, is the district head-quarters, and has a monopoly of the transit trade with Rangoon, Calcutta, and Malaya. Area, 5808 sq. miles; pop. (district), 110,000; (town), 25,000.

Taxa'ceæ, a sub-order of Coniferæ, sometimes regarded as a distinct order, comprising the yew tree (Taxus) and other trees or shrubs which inhabit chiefly the temperate parts of Europe, Asia, Africa, and America.

Taxation. The compulsory levies which a central government makes upon the citizens of a state for funds with which to carry on the national services are called taxes, while the levies of local government authorities are called rates. The national system of taxation is generally regarded as including both rates and taxes. Besides this broad division, based upon the character of the authority by whom the levy is made, there are many different ways in which taxes may be classified. Of these the most familiar is the distinction drawn between 'direct' and 'indirect' taxation. Direct taxes are assessed upon corporations or individuals, and are generally intended to fall upon those who pay them, and not to be passed on to others. Indirect taxes are assessed upon goods, and their burden tends to be passed on with the goods until it reaches the consumer, upon whom it ultimately falls. Some taxes do not fit conveniently into this classification. On the whole, however, it is the most important and useful method of discriminating between sources of national revenue, and it has been generally adopted.

Direct Taxation.—The most productive tax imposed in this country has for many years been the *income tax.* This is a charge upon income and profits of every description, designed to fall directly upon the recipient of income, and graduated in proportion to his wealth. It was originally instituted in 1798, during the war with France, and it was repealed in 1815. In 1842 it was reimposed by Sir Robert Peel, as a substitute for a large number of duties on imports and exports, to tide over the institution of free trade finance. It was again regarded as a temporary expedient; but it proved too productive to be discarded, and it has not only become permanent and the largest source of national revenue, but the rate at which it is levied has steadily risen. In the years immediately preceding the European War, the income tax stood at 1*s.* 2*d.* in the pound. Incomes under £160 were exempt from this tax. Earned income was taxed at the rate of 9*d.* in the pound if the total income did not exceed £2000, at 1*s.* if it did not exceed £3000. Earned incomes over £3000, and all incomes from property, were taxed in full, subject to abatements for individuals whose total income did not exceed £700. Super tax at 6*d.* in the pound on all income in excess of £3000 was also levied on those whose incomes exceeded £5000. During the War the income-tax rate rose rapidly, until, in 1918, it reached 6*s.* in the pound; while, in the same year, the super-tax limit was lowered to £2500 (on income in excess of £2000), and a sliding scale, rising to 4*s.* 6*d.* in the pound on very large incomes, was introduced. Income tax is levied, as far as possible, at the source; that is to say, profits are taxed before they are distributed; but super tax has to be assessed directly upon individuals.

Another very important branch of direct taxation is comprised in the *death duties.* These are charges imposed by the Government upon property which is being transferred from the dead to the living. Very large sums pass into the national exchequer through this channel, and since the power to inherit property is conferred by the State, it is fitting that it should be subject to a substantial contribution to State funds. An objection to heavy death duties is sometimes based upon the ground that they constitute a tax upon capital, and therefore tend to diminish the capital available for industry. The validity of this argument appears, however, to depend upon the assumption that incomes are never saved, and that capital is never squandered.

Indirect Taxes.—The taxes levied upon commodities are divided into two groups: *customs duties,* which are charged upon articles imported from other countries; and *excise duties,* which fall upon commodities produced at home. Under a system of protection (q.v.) customs duties are imposed for other than revenue-raising purposes; but in free trade (q.v.) an excise duty equal in amount to the customs duty is placed upon any home product which competes with a taxed import.

Local Taxation.—Local government authorities frequently derive revenue from the ownership of property and from trading monopolies, such as water, gas, electricity, and tramway services; but they also raise money by taxation. The principal instrument of local taxation is a *rate* levied upon the rent of real property, such as lands, houses, railways, and mines. The incidence of these rates is a frequent subject of dispute, but, though the duty of paying the rates is sometimes apportioned between the owner and the occupier of property, there can be no doubt that, as a rule, they are deducted in the long run from the rent obtainable.

Equity in Taxation.—Adam Smith laid down four maxims with regard to the conditions which a good system of taxation should fulfil; and, though many economists and statesmen have tried to improve upon them, they still command general assent. These maxims are: "(1) The subjects of every State ought to contribute towards the support of the Government as nearly as possible in proportion to their respective abilities, that is, in proportion to the revenue which they respectively enjoy under the protection of the State. (2) The tax which each individual is bound to pay ought to be certain and not arbitrary. The form of payment, the manner of payment, the quantity to be paid ought to be clear and plain to the contributor and to every other person. (3) Every tax ought to be levied at the time or in the manner in which it is most likely to be convenient for the contributor to pay it. (4) Every tax ought to be so contrived as both to take out and to keep out of the pockets of the people as little as possible, over and above what it brings into the public treasury of the State."

To these canons of taxation little need be added. In practice, however, there is often a conflict between the desirability of making each citizen conscious that he is contributing his share to the national exchequer, and the natural desire of a Government to extract 'the maximum of feathers with the minimum of squeals'.

Taxidermy, the preservation of the skins of animals, birds, or fishes, and the mounting of them to display, as far as possible, the creature in a life-like form, is a comparatively modern art, little more than three hundred years old. It was practised in this country in the seventeenth century, as is shown by the natural-history specimens in the Sloane collection; but till about 1850 British practitioners were far behind both French and German. Since then, however, great advances have been made in British work, and the best artists here and in America have now little to learn from the Continent. The first step in taxidermy is obviously the stripping of the skin from the dead body, which must be accomplished without damage to the fur of animals, the feathers of birds, or the scales of fishes. Next come the measures for preserving the skin from decay. The preparations in use are of many different kinds. Those containing arsenical soap or corrosive sublimate are effective, but highly poisonous, and may be dangerous to the lungs and blood of the worker. A mixture of burnt alum and saltpetre is effective for most mammals, while fur and feathers are usually treated with benzoline. In *setting up* the specimen, stuffing is now almost discarded. A copy is made of the animal, posed in a natural and life-like position, and from this a 'manikin' of light material is constructed, to which the skin is fitted with much artistry and care. The inside of the jaws and mouth is moulded of some plastic material; while the old-fashioned staring and expressionless glass eyes have given place to hand-painted models of the living organ. In modern natural-history museums the finished figure is given an elaborate setting which reproduces the natural habitat. With such perfection of reproduction in view, it is obvious that the taxidermist must have not only much artistic taste and manual skill, but also a fairly wide knowledge of the habits and appearance in life of the animals with which he deals.—Cf. Montagu Browne, *Artistic and Scientific Taxidermy*.

Taximeter, an instrument by means of which the distance travelled by a motor or other vehicle may be recorded in terms of the hire rate. They are most commonly used in cabs. The mileage records are obtained from a train of gearing, the first wheel of which receives its motion from one of the front wheels by a flexible shaft. On the last wheel of the train there is a pin fitted at the point corresponding to the performance of a complete mile of travel, and followed by others to represent the additional quarter miles. Other settings than that indicated are, of course, possible. The position of a metal flag indicates whether the mechanism is in operation or not. As a car may be engaged on a combined system allowing for running- and waiting-time, clockwork is fitted to operate similar gear to that mentioned above when the car is stopped. The instruments fitted to taxi-cabs are subjected to tests by the local authorities before being put into service.

Taxo'dium, a genus of plants, nat. ord. Coniferæ. The *T. distichum*, or deciduous cypress, a common ornamental tree upon English lawns, is a native of North America. When growing in swamps, as it often does, it develops cone-shaped breathing-roots. The bark exudes a resin which is used by the negroes for dressing wounds, and the roots, which are hollow inside, are used for bee-hives.

Tay, the longest river in Scotland, and the one that carries to the sea a greater volume of water than any other in the British Islands. It rises on the north side of Ben Lui, near the borders of Argyllshire and Perthshire; is known in its earliest course as the Fillan, and enters Loch Tay (after being joined by the Lochy) as the Dochart; issues thence as the River Tay, and receives in its course the Lyon, Tummel, Garry, Isla, Bran, Earn, Almond, &c., passes the towns of Aberfeldy, Dunkeld, and Perth; and at the latter place widens out into the Firth of Tay, and finally enters the North Sea after a course of 120 miles. The drainage basin is 2400 sq. miles. The estuary is from 1 to 3½ miles wide. It is navigable as far as Perth, but Dundee is the chief port. The salmon-fisheries are important.

Tay, Loch, a loch of Scotland, in the county of Perth, 15 miles long and about 1 mile broad; receiving at its south-west end the Lochy and the Dochart, and discharging at its north-east end at Kenmore by the Tay. It is 508 feet deep (maximum), and is famous for salmon.

Tay Bridge, a great railway bridge in Scotland crossing the estuary of the Tay from Fifeshire to Forfarshire at Dundee. The first bridge built here was opened for traffic in 1878. It was nearly 2 miles long, and had eighty-four spans, thirteen of which were blown down during the passage of a passenger train in a violent storm on the 28th Dec., 1879. A new and more substantial bridge (2 miles 73 yards long), containing eighty-five piers, was opened in June, 1887.

Taylor, Bayard, American author, born 1825, died 1878. He learned the trade of a printer, contributed to various magazines, made a journey through Europe on foot in 1844–5, on his return published *Views Afoot in Europe*, and in this way gained a position on the staff of the *New York Tribune*. He afterwards travelled extensively in Mexico, Egypt, Syria, Asia Minor, China, India, Japan, Greece, Sweden, and Russia, relating his experiences in numerous books. He is chiefly remembered for his complete translation of Goethe's *Faust* in the original metres; this is probably the best English translation of the poem. He resided in Germany for lengthened periods, was for some time United States Secretary of Legation at St. Petersburg, and was afterwards United States Ambassador at Berlin, where he died.

Taylor, Brook, English mathematician, born 1685, died 1731. Chosen a Fellow of the Royal Society, he became its secretary in 1714, an office which he retained four years. His chief works are: *Methodus Incrementorum Directa et Inversa* (London, 1715) and *Linear Perspective* (London, 1715). He was discoverer of the mathematical formula called *Taylor's Theorem* (q.v.), of extensive application in the higher mathematics.

Taylor, Jeremy, English prelate and author, born in 1613 at Cambridge, died at Lisburn, Ireland, in 1667. Educated at Perse's Free School in his native place, he entered Gonville and Caius College as a sizar in 1626. He graduated M.A., and in 1636 obtained, by the patronage of Archbishop Laud, a fellowship at All Souls College, Oxford. In 1638 he was presented by Bishop Juxon to the rectory of Uppingham, in Rutlandshire, and in 1642 he was appointed chaplain in ordinary to Charles I. After the outbreak of the Civil War he continued to attend Charles as chaplain, and when the Parliamentary party proved victorious he was frequently imprisoned for short periods. Eventually he retired into Wales, where he was received by the Earl of Carbery, under whose protection he was allowed to exercise his ministry and keep a school. Afterwards he removed to London, but in 1658 he accepted an invitation from Lord Conway to reside at his seat in Ireland. Here he remained until the Restoration, when he was elevated to the Irish see of Down and Connor, with the administration of that of Dromore. He was also, in the same year, made a Privy Councillor for Ireland, and chosen vice-chancellor of the University of Dublin. The greater part of his writings consists of sermons and devotional pieces, and upon the former rests his fame as a master of varied English prose.—*Cf.* E. W. Gosse, *Jeremy Taylor* (English Men of Letters Series).

Taylor, John, usually called the *water-poet*, was born in Gloucester about 1580, and died in 1653. He served an apprenticeship to a waterman, was at the taking of Cadiz, under the Earl of Essex, in 1596, and was many years collector of the wine dues exacted by the lieutenant of the Tower of London. He afterwards kept a tavern, first at Oxford and then at Westminster. His pieces to the number of sixty-three were published in a folio volume in 1630, but he was the author of about one hundred and fifty publications, both in prose and verse. They are characterized by a certain rough vigour not free from vulgarity. His works, among which may be mentioned *Penniless Pilgrimage* (1618); *Laugh and Be Fat* (1613); *Three Weeks', Three Days', and Three Hours' Observations and Travel from London to Hamburgh* (1617), were reprinted by the Spenser Society (1868–9 and 1870–8).

Taylor, Thomas, the 'Platonist', born in London 1758, died at Walworth 1835. He studied with a view to the dissenting ministry, but entered a banking-house, when all his leisure was devoted to classical and philosophical studies. He published, chiefly with the aid of patrons, about forty different works, the most remarkable of which are *Plato* (5 vols. 4to, 1804), printed at the expense of the Duke of Norfolk, who kept almost the whole edition locked up till 1848; and *Aristotle* (10 vols. 1806–12).

Taylor, Tom, British dramatist, born 1817, died 1880. Educated at Glasgow University and Trinity College, Cambridge, he became professor in University College, London; was called to the Bar (1845), and went on the northern circuit; appointed (1854) secretary to the Board of Health; wrote and adapted for the stage a great number of plays; and succeeded Shirley Brooks (1873) as editor of *Punch*. The most popular of his plays were: *New Men and Old Acres*, *Masks and Faces* (in collaboration with Charles Reade), *Still Waters Run Deep*, *The Overland Route*, and *The Ticket of Leave Man*.

Taylor, William, born at Norwich in 1765, died 1836. He was educated for a mercantile career, but after a lengthened stay in Germany he resolved to devote himself to literature. His published works are: a translation of Bürger's *Lenore* (1796) and Lessing's *Nathan the Wise* (1805), *English Synonyms Discriminated* (1813), and *A Historic Survey of German Poetry* (1828). George Borrow has described him as the "elderly individual" in *Lavengro*, chapter xxiii.

Taylor, Zachary, twelfth President of the United States, born in Virginia 1784, died in 1850. He entered the army in 1808, and rose to the rank of major; took command of the United States forces at the outbreak of the Mexican War, repeatedly defeated the Mexicans, and finally triumphed over Santa Anna in the battle of Buena Vista (1847). Having returned to the United States, his popularity caused him to be elected President; but 'Old-rough-and-ready', as he was called, only held this position for a few months.

Taylor Institution, an institution in connection with Oxford University, designed mainly for the promotion of the study of modern European languages. It owes its foundation to a bequest of Sir Robert Taylor (1714–88), and the building belonging to it was erected in 1848, after a design by C. R. Cockerell.

Taylor's Theorem, a formula essentially identical with Maclaurin's Theorem (q.v.), but more convenient in form for some applications. If $f(x)$ is a function of x, the theorem is that

$$f(b) = f(a) + \frac{b-a}{1}f'(a) + \frac{(b-a)^2}{1\cdot 2}f''(a) + \cdots + \frac{(b-a)^n}{n!}f^{(n)}\{a + \theta(b-a)\},$$

where θ is a positive proper fraction. Under certain conditions, which can be proved to be fulfilled by all the ordinary functions of analysis, the series can be continued to infinity.—Cf. G. A. Gibson, *Elementary Treatise on the Calculus*.

Tchad, or **Chad**, a freshwater lake of Central Africa, the nodal point of the French-African and British-Nigerian frontiers; area, formerly estimated at 20,000 sq. miles, now at 7000 sq. miles, with a variable expanse according as it is the wet or dry season. It receives the drainage of the Shari and Lagone valleys, but has no outlet. Numerous small islands are studded over the surface, and these are densely peopled, as are also the shores in many places, especially on the south-west, where is the large town Kuka.

Tchad, or **Chad**, a colony of French Equatorial Africa. Large herds of camels, horses, sheep, asses, and ostriches are raised, and zinc, lead, and copper exist; but there is no export. Area, 501,676 sq. miles; pop. 2,090,000.

Tchelyabinsk, a town of Russia, in the government of Oxenburg, on the Miyas; an important railway junction of the Trans-Ural lines from Perm and Ufa (see *Saratov*), which, at this point, join the Trans-Siberian line for Irkutsk. There are grain mills, manufactures of leather, &c., and several printing works. Trade is brisk in grain, agricultural machinery, and textiles. Pop. 26,000.

Tcherkasy, a town and river-port of Ukraine, in the government of Kiev, on the Dnieper; served by the railway to Odessa (via Voznesensk). Sugar and tobacco are manufactured, and there are sawmills. Trade is chiefly in grain, salt, sugar, cattle, and wood. Pop. 36,000 (mainly Little Russians, Poles, and Jews).

Tchernigov, or **Tchernigow**, a former government of South Russia, in the Ukraine; area, 20,232 sq. miles. It is mainly an undulating plain watered by the Seim, Desna, and Dnieper. Agriculture and cattle-breeding are the chief employments of the region. The republican (Ukrainian) province of Tchernigov has an area of 12,648 sq. miles and a population of (1923) 1,809,918. The population of the Imperial government was (1914) 3,084,000.

Tchernigov, a town of Ukraine, capital of the government of Tchernigov, on the Desna; served by a branch of the Kiev-Voronezh (and Moscow) Railway. Pop. 32,840.

Tchern'ozem, the name for the 'black soil' of Russia, rich in nitrogen and naturally the most fertile soil on the globe. It runs as a belt between the Carpathians and the Ural Mountains, and varies in depth from 4 to 20 feet. In the Ukraine it is at its best and widest.

Tchudes, a subdivision of the Finnic branch of the Finno-Ugric division of the Ural-Altaic family of languages. The Vepsas (Northern Tchudes) are found from east of Lake Ladoga to south-west of Lake Onega: number, 25,000. The Votes (Southern Tchudes) inhabit part of Ingria (the Petrograd district): number, 14,000. Vepsic and Votic are cognate dialects much allied to the Esthonian (and Livonian) language.

Tea Plant

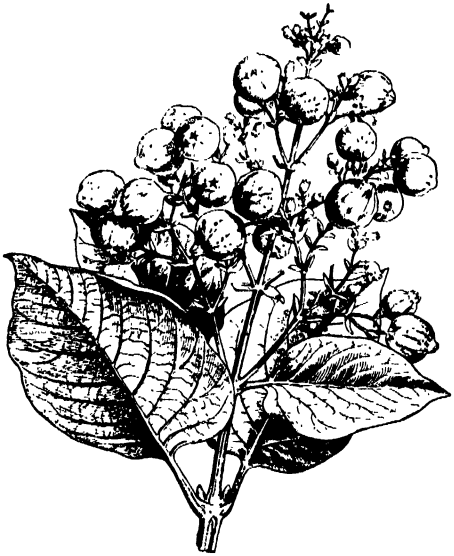
Tea (Thea), a genus of plants, nat. ord. Ternstrœmiaceæ (that to which the camellia belongs), comprising the species (*T. sinensis* or *chinensis*) which yields most of the tea of commerce. By different modes of culture this species has diverged into two distinct varieties, entitled

Thea viridis and *Thea bohea*. The former is a large hardy evergreen plant with spreading branches and thin leaves from 3 to 5 inches long; the latter is a smaller plant, and differs from the other in several particulars. From both, according to the process of manufacture, black and green teas are procured. The tea plant is not only cultivated over a great part of China, but also in Japan, Tonquin, Cochin-China, Assam and other parts of India, and Ceylon. It has also been introduced into the United States, Brazil, South Africa, and Australia. Its growth is chiefly confined to hilly tracts; it is raised from seed, and the rearing of it requires great skill and attention. In seven years the plant attains the height of 6 feet, and the leaves are plucked off carefully one by one four times a year. In their green condition they are placed in a hot pan over a small furnace, and then rubbed lightly between the palms of the hands, or on a table. This process is repeated until the leaves become small, crisp, and curled. The black teas thus prepared include bohea, congou, souchong, and pekoe; the green teas, twankay, hyson-skin, young hyson, hyson, imperial, and gunpowder. Green tea gets less of the fire than black tea. The broken leaves, stalks, and refuse of the tea are compressed into solid bricks, and in this form it is imported by the Russians into the greater part of Central Asia, where (besides being used as a sort of coinage) it is sometimes stewed with milk, salt, and butter. There is considerable adulteration in the teas sent from China to the European market, and they are often artificially coloured with a mixture of Prussian blue, or of gypsum and indigo carefully mixed. The infusion of tea-leaves in hot water yields a beverage which has little nutritive value, but which increases respiratory action, and seems to have a stimulative and restorative action on the nervous system. This is chiefly due to the essential oil and the theine (a base in its nature identical with the caffeine in coffee) which it contains, whilst the tannin, which is also present, acts as an astringent. If the water is boiling, an infusion of ten minutes is sufficient to extract all the theine, and a longer period only adds to the tannin in the beverage, a result which is very hurtful to digestion. From historical sources we learn that tea was used in China as a beverage in the sixth century, and two centuries after its use had become common. In England we first find it mentioned about 1615 by an agent of the East India Company; in 1660 Pepys says in his diary, "I did send for a cup of tea, a China drink, of which I never had drunk before"; and in 1664 the East India Company made a present to the king of 2 lb. 2 oz. In the year 1678 the import of tea to Britain was 5000 lb., forty years after it reached 1,000,000 lb., and in 1921 the total import was

From.	Lb.	Value.
India	286,582,583	£14,871,952
Ceylon	118,755,568	6,654,729
Java	24,499,826	863,264
China	4,629,506	245,730
Totals	434,467,483	£22,635,675

China used to hold almost a monopoly in the production of tea, but first India and then Ceylon (after 1873) became important competitors, and now the bulk of all the tea brought to Britain is the produce of these countries. Britain is the principal tea-consuming country in the world, coffee being less in favour there than in many other countries, the United States and Canada for example. The import of tea to the United States is less than half that of Britain. In 1921–2 the tea duty yielded to Britain a revenue of £17,582,517.

Teak (*Tectōna grandis*), a tree of the nat. ord. Verbenaceæ, a native of different parts of India, as well as of Burma and of the islands from Ceylon to the Moluccas. It grows to an immense size, and is remarkable for its large leaves, which are from 12 to 24 inches long, and from 6 to 18 inches broad. The wood, though porous, is strong and durable; it is easily seasoned and shrinks but little, and from containing a resinous


Leaves and Fruit of the Teak Tree

oil it resists the action of water, and repels the attacks of insects of all kinds. It is extensively used in shipbuilding and for many other purposes.—*African teak*, a timber similar to East Indian teak, is believed to be the produce of *Oldfieldia africana*, nat. ord. Euphorbiaceæ.

Teal, the common name for freshwater ducks of the genus Nettion, the smallest and most beautiful of the Anatidæ, or duck family. The common teal (*N. crecca*) ranges through Europe and most of temperate Asia. It comes to England about the end of September and remains till spring, but in many parts of Scotland it remains all the year. Its length is about 14 inches. The North American green-winged teal (*N. carolinense*) is very like the common teal.

Teasel, the English name of several plants of the genus Dipsăcus, nat. ord. Dipsaceæ, allied to the composite order. One species (*D. sylvestris*) grows wild in England, being a strong prickly plant 4 to 6 feet high. Another species, the fuller's teasel (*D. fullōnum*), by some regarded as a mere variety, is cultivated for the sake of the awns of the head, which are employed to raise the nap of woollen cloths. For this purpose the heads are fixed round the circumference of a large wheel, which is made to turn round while the cloth is held against the brush thus formed, and the fine hooked awn of the teasel draws out with it some of the fine fibres of the wool. These are then shorn smooth, and the cloth is left with a fine velvety nap.

Fuller's Teasel

Teco'ma, a genus of plants, nat. ord. Bignoniaceæ—trees or shrubs or climbing plants, with unequally pinnate or digitate simple leaves, and terminal panicles of dusky red or orange flowers. They are natives of tropical and subtropical climates, and some, as *T. impetiginosa*, are medicinal.

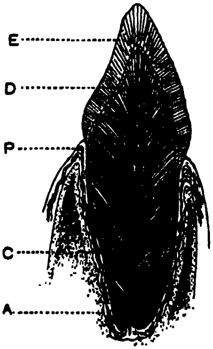
Tectibranchia'ta, a sub-order of the hind-gilled snails (Opisthobranchia), in which the gills are protected by a shell, or by the mantle. Examples are the bubble-shells (Bulla) and the sea-hare (Aplysia).

Teddington, an urban district of England, in the county of Middlesex, on the Thames. It is largely residential, and contains the National Physical Laboratory for mechanical and industrial research. Pop. (1921), 21,200.

Te Deum, a name (from the opening phrase *Te Deum laudamus*) of the well-known Latin hymn usually ascribed to St. Ambrose and St. Augustine, although it cannot be traced farther back than the end of the fifth century. It is used in the ritual of the Roman Catholic and Anglican Churches, being part of the morning service in the latter ('We praise thee, O God', &c.).

Tees, a river of England, rising near Cross Fell, in Cumberland, and flowing towards the North Sea, its upper course forming the boundary between Westmorland and Durham. In its lower course it is of commercial importance, and it is estuarine below Middlesborough. Stockton and Thornaby are on its banks. Length, 80 miles; catchment basin, 708 sq. miles (approximate).

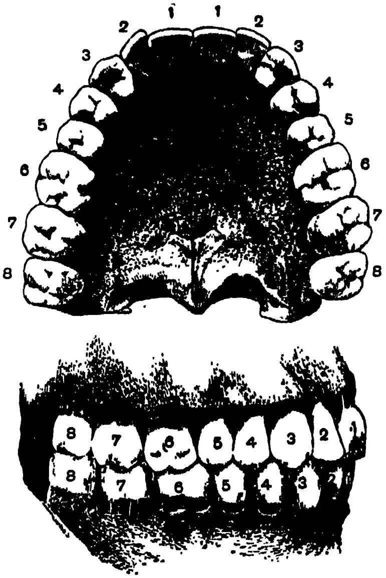
Teeth, the name given to certain hard structures growing out of the jaws of vertebrate animals, and serving as the instrument of mastication. The teeth of animals differ in shape, being destined for different offices. In man and the higher mammals two sets of teeth are developed, the early, milk, or deciduous teeth, and the permanent set. In fishes the teeth fall off and are renewed repeatedly in the course of their lives. Teeth do not belong to the skeleton, but to the skin or exoskeletal parts of the body, and are homologous with hairs. In man the teeth are embedded in sockets in the upper and lower jaw-bones. There are thirty-two in all, sixteen in each jaw, and each consists of the crown or visible part, and the fangs or buried part. The four central teeth of each jaw having



Section of Canine Tooth

E, Enamel prisms. D, Dentine. P, Pulp cavity. C, Cement. A, Periosteum of alveolus.

chisel-shaped crowns with sharp edges are called incisors; on each side of these four is the pointed canine tooth (which in the upper jaw is called the eye-tooth); next to these on each side are two bicuspid teeth (præmolars); and behind these again are the molar teeth, three on each side. (See *Dental Formula.*) The last of the permanent teeth to appear are the farthest back grinding teeth, which, owing to their arrival between the seventeenth and twenty-fifth years, are called the wisdom teeth. Each tooth has a central cavity filled with a soft pulp containing blood-vessels and nerves; this cavity is surrounded by dentine, a hard substance composed of phosphate and carbonate of lime; outside the fang is a cement-like substance resembling bone; while outside the crown is a hard enamel. In young teeth the enamel is covered by a delicate membrane called ‘the skin of the teeth’, which in adult teeth is worn off. Toothache is due to decay, or caries, of the substance of a tooth. Tartar is an earthy substance which occasionally concretes upon the teeth, being deposited from the saliva. When the enamel which covers the tooth becomes flawed, the underlying dentine is exposed and soon breaks down. When the decay, passing inward, reaches the pulp which contains the blood-vessels and nerves, it causes inflammation, aching, and suppuration. Any treatment of toothache, short of extraction, is seldom satisfactory if the pulp has been actually attacked; but neuralgia is often mistaken for toothache.



Teeth: the Arrangement of Permanent Teeth in a normal Adult

Incisors: 1, Central; 2, Lateral. Canine: 3, Premolars: 4, First; 5, Second. Molars: 6, First or 6 year; 7, Second or 12 year; 8, Third molar or wisdom tooth.

Teething is applied to the eruption of the temporary, or milk, teeth in children, and there is a widespread belief that many disturbances in health are due to this cause, and that it is the origin of certain serious diseases. Most healthy children, however, cut their teeth without any further disturbance than a few days of abnormal irritability, due to the pain of the swollen and tender gum over the erupting tooth. In debilitated children, and in those of a nervous type, there is often associated with teething considerable general disturbance of the health of the child, and a rapid rise in temperature may take place with the usual symptoms of feverishness, while convulsive seizures may occur along with the eruption of a tooth in such children. Delay in the appearance of the teeth is one of the signs of constitutional disturbance, and is frequently observed in rickets.

Tegnér (teng′nār), Esaias, Swedish poet, born in 1782, died in 1846. He studied at the University of Lund, became in 1812 professor of Greek literature, and in 1824 was appointed Bishop of Wexiö. His works include: *Frithjofs Saga*, an epic poem, translated once at least into each European language; and *The Children of the Lord's Supper*, translated by Longfellow.

Tegucigalpa, a department of Honduras, Central America, mountainous and forest-clad. Iron, copper, silver, gold, and coal are produced, with grain, &c., in the valleys. Pop. 90–100,000.

Tegucigalpa, the capital of Honduras and of Tegucigalpa province, on the Choluteca, the principal distributing centre for the Republic. It has a cathedral, &c., and is connected by rail with the port of San Lorenzo, on Fonseca Bay. Pop. 22,900.

Tehrān, a province of Persia, comprising the districts of Shahriar, Shimran, Saujbulagh, Feshaviyeh, Kasran, and Veramin.

Tehrān, or **Teheran′**, capital of Persia and of the province of Tehrān, at the southern base of Mount Elburz. It has an enceinte on Vauban's principle, pierced by twelve gates, with stone bridges crossing the ditch. The main streets lead to the bazaar in the centre, and there are various squares or open spaces. The citadel-palace of the shah is important, but the city is not rich in buildings. There are numerous mosques, a high school or college, &c. There is a single-line tramway system, and a short railway runs to Shah-Abdul-Azim (1-metre gauge; 5½ miles long). During the hotter months the court removes to the heights on the north, and a third of the inhabitants (including the European embassies) follow. The principal manufactures are carpets, silks, cottons, and hardware; there is a large caravan trade. Pop. (in winter), about 280,000.

Tehuantepec (tā-wȧn-te-pek'), a town of Mexico, in the state of Oaxaca. It gives name to the isthmus, gulf, and inter-oceanic railway. Pop. 9000. The town is near the south side of the Isthmus of Tehuantepec, the narrowest part of North America, having the Gulf of Tehuantepec on the Pacific side, and the Gulf of Campeachy on the Atlantic side; width, about 125 miles.

Teignmouth (tăn'muth), a seaport and market town of England, in the county of Devon, at the mouth of the Teign. Teignmouth is much frequented as a seaside-resort, and there is a pleasure pier, with a promenade. The fisheries, brewing, and boatbuilding employ a number of the inhabitants. Pop. (1921), 11,000.

Teinds (tēnds), the Scots law term for tenths or tithes of the fruits of the land. In the majority of instances the teinds now belong to the owners of the land formerly paying them, to the Crown, or other proprietors, they being charged in all cases with the payment of the parish minister's stipend.

Teju, or **Teguixin** (te-gek'sin; *Tupinambis teguixin*), one of the greaved lizards inhabiting tropical America. A full-grown specimen may exceed 3 feet in length. They inhabit forest regions, and devour worms, insects, frogs, snakes, small rodents, and birds. Their hard-shelled eggs are laid in burrows.

Telau'tograph. The telegraphing of pictures over long distances has attracted the attention of many inventors, but it is to Professor Korn that the main credit is due for work in this field. In his telautographic process the photograph which is to be transmitted is printed as a half-tone picture on a sheet of lead foil. An insulating substance, such as fish-glue, is used as the printing material. If an electric circuit is completed through a stylus, the picture, and the metal drum it is fitted to, the current would be interrupted whenever the glue came between the stylus and the drum. By rotating the drum and also giving it a longitudinal motion, every part of the picture will come under the stylus at some period. The current passing will be an interrupted one, and may be used at the receiving end to build up the original illustration. For reception, a drum with the same motion as the transmitting one has a wrapping of a prepared paper on which a metallic stylus presses. The paper is an electrical conductor and contains an electrolyte, the splitting up of which causes a coloration. When the currents from the receiving end are passed through the paper, the coloration corresponds to the uncovered part of the transmitted photograph. Whenever there is no current passing, the paper remains plain. The system has been in use between some of the chief cities of Europe for some years. By using the interrupted currents to actuate a wireless transmitting set, it is possible to use ether waves as the connecting-link between receiver and transmitter. The use of selenium cells for the transmission of electrical energy proportionate to the light reflection from the various parts of a photographic illustration has also been successfully used for telegraphing pictures.

Tel'edu, a carnivorous mammal (*Mydaus meliceps*), family Mustelidæ, allied to the skunk, and, like it, capable of diffusing a most abominable stench. It is native to Java and Sumatra.

Teleg'raphy, the transmission of messages to a distance. The word signifies that the messages are written, but it has been used to denote any method by which signals may be conveyed to a distance, as by the semaphore and by the ship's telegraph. With present-day use, the word implies that the messages are sent by electricity, whether through space (see *Wireless Telegraphy*) or by means of conducting lines.

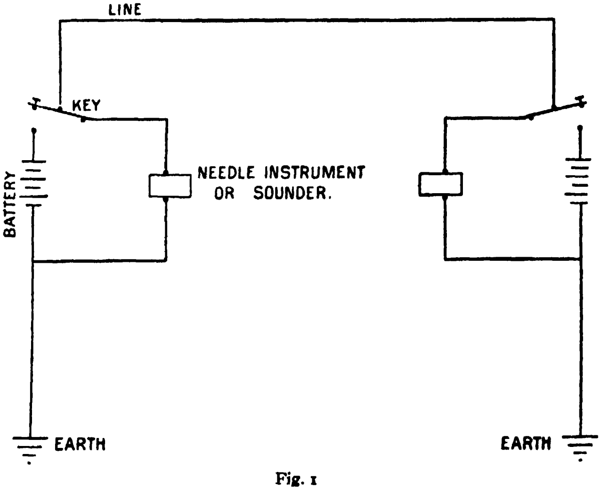


Fig. 1

The principle almost universally employed in line telegraphy is that of the electromagnetic action of the current. Attempts to convey intelligence by means of the electric current began about the end of the eighteenth century. In 1820, after Oersted's discovery of the magnetic effect of a current on a compass needle, Ampère suggested that the effect might be employed for the purpose of transmitting signals. Gauss and Weber at Göttingen constructed an electromagnetic instrument by means of which messages were sent a distance of 1¼ miles. The year 1837 saw several important developments in telegraphic instruments. Cooke and Wheatstone introduced a five-needle instrument which, however, required five lines; in America, Morse developed a very complete system of telegraphy; and in Munich, Steinheil employed the earth as a return lead for the current.

The essentials of a telegraphic system are a transmitting mechanism, a line to conduct the current from the transmitter to the receiver, and a receiving mechanism. The diagram (fig. 1) of a simple telegraphic circuit shows the method of connecting these. Each station contains a battery, a key for connecting the battery to the line, a needle instrument the indications of which can be read off by eye, or a sounder which renders the signals audible to the receiving operator. The key shown is of the Morse type, suitable for use with a sounder, and it is kept in the position shown by a spring. When signals are to be sent from one station to the other, the operator presses the key, and the current flows from the battery along the line to the other station, where it actuates the needle or sounder and flows back to the battery by the respective 'earths'.

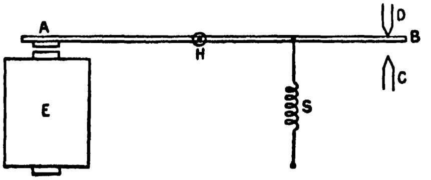


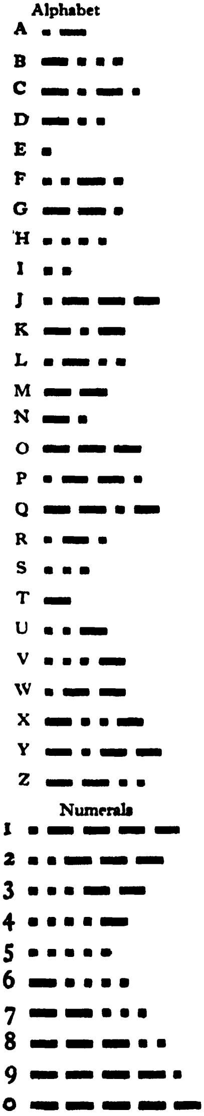
Fig. 2

Batteries.—The cells used in telegraphy are of the Daniell, bichromate, and Leclanché types; in some cases dry cells are used, and in large offices the current is supplied by accumulators.

Receiving Apparatus.—The usual instruments employed in the reception of signals are the needle instrument and the sounder; other instruments have also been used, such as the Wheatstone dial telegraph which spells out the words on an alphabetic dial. In Cowper's telegraph the messages were received in the written form. Morse's printer records the signals, on a paper strip, in the form of dots and dashes; these were originally indented on the paper by means of a point or style, but an ink-wheel was substituted by John in 1854 which gave a more legible record. In Hughes's type-printing machine the words are printed somewhat as in a typewriter. Bain's recording instrument employs the electrolytic effect of the current on a chemically prepared paper.

Single-needle Instrument.—This development of Wheatstone's five-needle instrument is a species of galvanoscope, and consists of a vertical needle with coils on each side, through which the current flows. The current may be passed through the coils in either direction by means of a double tapping-key. These currents deflect the needle to the left or right, a motion to the left representing a dot, and one to the right a dash. The instrument is sensitive, but slow in action compared with the sounder; it is widely used on railway telegraph systems. In one form two tin sounders are placed at the sides so that the instrument may also act as a sounder. Permanent magnets are placed in the instrument to prevent the needle from becoming demagnetized.

Sounder.—The essential parts of a sounder of the Morse type are (see fig. 2) an electromagnet E, a soft-iron armature A, a lever AB, hinged at H and movable between two stops C and D. The lever is held by the spring S against the stop C until, on a current flowing through E, the armature A is attracted and the lever hits the stop D. When the current ceases, the lever returns to the stop C. Sounds are thus made which represent dots and dashes according to the length of the interval between consecutive hits of a stop. No reversal of current is required for this instrument; it is simpler in construction than the needle instrument, and more rapid in action, but requires a stronger current.



Alphabet	
A	· —
B	— · · ·
C	— · — ·
D	— · ·
E	·
F	· · — ·
G	— — ·
H	· · · ·
I	· ·
J	· — — —
K	— · —
L	· — · ·
M	— —
N	— ·
O	— — —
P	· — — ·
Q	— — · —
R	· — ·
S	· · ·
T	—
U	· · —
V	· · · —
W	· — —
X	— · · —
Y	— · — —
Z	— — · ·
Numerals	
1	· — — — —
2	· · — — —
3	· · · — —
4	· · · · —
5	· · · · ·
6	— · · · ·
7	— — · · ·
8	— — — · ·
9	— — — — ·
0	— — — — —

Fig. 3

Morse Key.—The transmitting key used with a sounder is the Morse key, shown in fig. 1.

Morse Code.—The dots and dashes recorded on a Morse printing-machine, or expressed by sounds of short and long duration, are the elements of an alphabetic code of signals. That in common use is the International Code, a modification of Morse's code. By different combinations of dots and dashes the various letters of the alphabet are represented, and it is possible in the case of a skilled operator to send messages by means of these at the rate of thirty to forty words per minute. See fig. 3.

Relay.—The systems described above cannot be worked at long distances with the usual size of battery, on account of the increase in the resistance of the circuit and the loss of power due to current leakage. A more delicate instrument, known as a relay, is consequently introduced into the circuit in place of the signalling instrument. The relay, when acted on by the current from the sending station, closes and opens a local circuit containing a battery and sounder. The action of a relay may be followed from the accompanying diagram (see fig. 4). The electromagnet E of the relay attracts the armature on the conducting arm AB, thus making contact with the stop C; the local battery circuit is then completed, and the current actuates the sounder S. Relays are distinguished as polarized or non-polarized according as they contain or do not contain permanent magnets; the type used in the British postal service is the polarized relay; it is the more sensitive form.

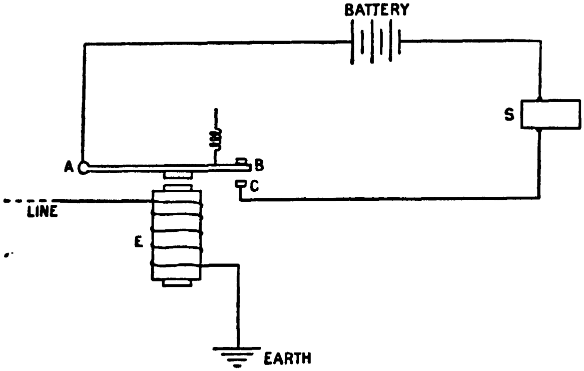


Fig. 4

The Line.—The electric current is led between two stations through a bare iron or copper wire suspended from porcelain insulators attached to telegraph poles placed 70 or 80 yards apart. The wire in common use is an iron wire about $\frac{1}{10}$ths of an inch in diameter. Besides being subject to loss of efficiency through current leakage, the working of the lines may be seriously disturbed by the action of storms and of lightning; the latter may fuse the wire, damage the poles and instruments, and endanger the safety of the operators. Magnetic storms, though not capable of causing such great havoc, have been known to upset the working of the lines for several hours.

Duplex Telegraphy.—When one line is used to carry messages in both directions, the system employed is known as duplex telegraphy. When two messages are sent through one wire in the same direction, the system used is called diplex. These may be extended to multiplex telegraphy, in which six messages are sent simultaneously along one wire.

Wheatstone's Automatic Telegraph.—Besides the methods indicated for using one line during busy periods to carry many messages, the speed of transmission has been greatly increased by the use of mechanical transmission and reception. In Wheatstone's automatic telegraph, which is used in this country, the message is first prepared by perforating a strip of paper with the required signs. The paper is then transferred to a transmitting machine, through which it is run rapidly, and a receiving machine records the signals in ink. The rate of transmission may attain a speed of 450 words per minute.

Submarine Telegraphy.—The conditions met with in sending electric currents through an insulated cable lying at the bottom of the sea are very different from those which hold for land systems. The insulating covering of the conductor must be strong enough to withstand the laying of the cable, and the action of sea-water and of a possibly rocky sea-bottom. Earth currents tend to disturb the working of a cable, but their action is neutralized by placing condensers at each end of the cable; their addition also increases the speed of transmission. Ordinary signalling apparatus cannot be used on long-distance cables, on account of the slowness with which signalling would be carried on, viz. about one word per minute.

Kelvin Mirror Galvanometer.—The instruments employed in receiving cable messages are Kelvin's mirror galvanometer and siphon recorder. The former may be considered as a very delicate needle instrument (see *Galvanometer*), with which a speed of about twenty words per minute can be attained.

Siphon Recorder.—This instrument was the first one in which the 'moving-coil' principle was used; it was invented by Lord Kelvin in

1867, and consists of a small coil suspended between the poles of an electromagnet. As the coil oscillates under the action of the variable current passing through it, it causes an ink-siphon to oscillate across the moving paper strip, on which the siphon pen writes the message in a form of Morse. Automatic transmission is also used on the principal cables. The Hughes printing-machine is employed on the shorter cables, such as those which cross the English Channel. Bibliography: Sir W. H. Preece and Sir J. Sivewright, *Text Book of Telegraphy*; T. E. Herbert, *Telegraphy*; C. Bright, *Submarine Telegraphs*; H. W. Pendry, *Elementary Telegraphy, A Manual for Students*; W. H. Jones, *Telegraphy for Beginners.*

Telemachus (te-lem′a-kus), in Greek legend, the son of Odysseus (Ulysses) and Penelope, who is reputed to have gone through many adventures in search of his father after the close of the Trojan War. He is the hero of a French prose epic by Fénelon (1699).

Teleol′ogy (Gr. *telos*, end, *logos*, science), the branch of philosophy which deals with ends and final causes. It also denotes the theory that the world has a design, and that there is a purposed end in it, controlling the course of events. Whilst the phenomena of the universe are determined by efficient causes, and are the result of certain laws, these laws and causes have a directive principle. In other words, the universe and all its phenomena cannot be explained by mechanical principles and the laws of causation. Most of the Greek philosophers—Anaxagoras, Socrates, Plato, Aristotle, and the Stoics—supported the doctrine. Descartes, Bacon, Hobbes, and Spinoza were opposed to it; but among modern philosophers Leibnitz, Kant, Schopenhauer, Ward, and Bosanquet have written in its favour. The doctrine received a severe backset from Darwin's *Origin of Species*, but certain biologists are once again inclined to advocate the theory.

Teleos′tei, a large and important order of fishes, distinguished primarily by the usually *bony* nature of the skeleton as compared with the cartilaginous skeletons of some other subclasses. Almost all our common fishes are included in this order. See *Ichthyology.*

Telep′athy, communication of impressions of any kind from one mind to another, independently of the recognized channels of sense. It connotes all communications between mind and mind, not only of persons who are at a considerable distance from each other, but also of those who happen to be in the same room, although in the latter case the communication is sometimes termed thought-transference. In 1876 Professor Sir W. F. Barrett drew attention to the fact that certain persons have the faculty of communicating and transferring ideas and impressions either spontaneously or intentionally, and the Society of Psychical Research has, ever since its establishment, collected and investigated the evidence in favour of telepathy. The term was introduced by Professor Myers in 1882. The evidence for telepathy consists of either experimental or spontaneous cases. In the former case the ' agent ' endeavours to communicate an idea or an impression to another person, the ' percipient ', to transfer a sensation, and even to produce an apparition of himself. In the latter case the ' agent ' intimates the existence of danger or distress, illness or death to a friend or relative at a distance. Although the evidence for the existence of telepathy seems to be conclusive, the nature of it is still a subject of discussion. Telepathy has been explained by some as physiological, by others as psychological. Some authorities are in favour of the idea of supernormal faculties, whilst others, like Sir Oliver Lodge, assume the existence of a subconscious mind. Others, however, like the late Sir W. Crookes, prefer a physiological explanation, and look upon the phenomena of telepathy as the result of brain-waves or vibrations connecting mind with mind. See *Psychical Research* for Bibliography.

Teleph′ony, the transmission of speech to a distance by means of the electric current. The process involves the use of a transmitter into which the message is spoken, a battery, conductors to connect the two stations, and a receiver in which the message is heard. The earliest telephone (1861) was that of Reis of Frankfort; its transmitter consisted of a diaphragm which, in vibrating, made momentary battery contacts, and the receiver was an electromagnet through which the intermittent currents flowed, and in so doing reproduced in some measure the sounds received by the transmitter. This acoustic property of the electromagnet had been demonstrated by Page in America in 1887.

Bell's Telephone.—The electromagnetic telephone was invented by Graham Bell in America in 1876. It consists of a permanent magnet NS (fig. 1) which carries a coil C at one end. In front of the magnet a thin soft-iron disc D is held with its edge fixed in a holder. The disc

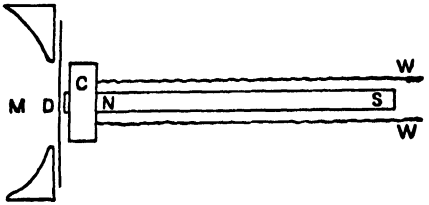


Fig. 1

vibrates in response to sounds which enter the mouthpiece M; these vibrations cause changes in the distribution of the magnetic field between the magnet and the disc, the latter acting as armature to the magnet; and this in turn sets up changes in the magnetic flux through the coil. Currents are induced, in the coil, which flow in one direction as the disc approaches the magnet, and in the opposite direction as the disc recedes. These alternating currents are led by the wires ww to a similar instrument, where their magnetic action sets another disc vibrating in the same manner as the first, and the sounds which enter the transmitting telephone are thus repeated in the receiving telephone. As the currents induced in the receiving telephone are feeble, the Bell system is not capable of transmitting speech to any great distance.

The Bell telephone has been modified in several particulars: a horse-shoe magnet is used instead of a rod; the poles are sometimes supplied with soft-iron ends; and chrom-cobalt steel now permits considerable reduction in the weight of the telephone. The length of the telephone has been shortened by bending the horse-shoe through a right angle, giving the 'watch' pattern of telephone; a combination of a pair of this type forms the head-phone used in radio-telegraphy. In the hand-phone as used with a table telephone there is a microphone transmitter and a watch receiver.

Carbon Transmitters.—In Edison's transmitter the vibrations of the diaphragm caused changes in the contact between a platinum plate and a carbon plate, between which a current flowed from a battery in the circuit. The variations of resistance which took place in the transmitter gave rise to variable currents which were led to the receiving apparatus. Blake's transmitter differed from that of Edison in having a platinum point pressing against the carbon plate; it gave very clear articulation, but was not so loud as the more modern transmitters. Hughes's microphone, owing probably to its simpler construction, smaller cost, and high efficiency, has displaced the Edison transmitter (see *Microphone*). Hunnings used a number of small carbon granules between the vibrating diaphragm and the carbon plate, and this form of transmitter, fitted with a device for preventing the granules from becoming tightly packed, is used at the present day.

Telephone Circuits.—The arrangement of battery, instruments, and connecting wires is known as the telephone circuit, and in the case of a large system the complete circuit becomes a complicated network. A simple domestic telephone circuit can be formed by adding two telephones of the hand-phone type to an electric bell circuit; such a circuit, with transmitter and receiver in series with the battery, belongs to what is known as the direct-working system.

Transformers.—The direct-working system is not applicable to large systems of lines, for the changes in a given microphone would cause current changes which would give strong signals on short lines and weak signals on long lines. Transformers are therefore employed in order to make the strength of the received signals independent of the resistance of the line. The sounds spoken into the microphone M (fig. 2) set up current variations in the primary coil P in the microphone circuit; these induce currents of higher voltage in the secondary coil S of the 'step-up' transformer or induction coil PS, and these induced currents actuate the telephone T at the receiving end of the line. The process can be carried out in the reverse direction.

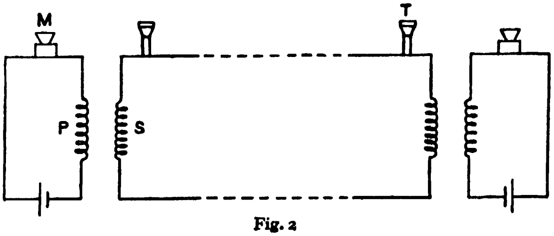


Fig. 2

Telephone Exchanges.—In order that the different members of a telephone system may be able to communicate with one another, wires are led from each instrument to a central office or exchange, where they terminate on a switchboard. The exchange operator, on being called, can connect any two lines as may be required.

Current.—The current for telephones is provided either by means of a magneto or by a battery. The magneto is a small alternating-current machine run by turning a handle. Current is required for ringing the bell and for use while speaking. It is common practice in telephone systems to use one battery as a source of current for all subscribers, this method of distributing current being called the common battery system. The battery, generally a storage one, is placed in the exchange, and when a receiving instrument is taken off its hook, the battery informs the exchange operator of this fact by working an indicator.

Intercommunicating Telephones.—In factories, public buildings, and large offices where much time may be spent in moving from one department to another, a telephonic system can be set up which enables each telephone to communicate with any other telephone on the system. This requires as many wires as there are instruments; and one wire is used as a common return. Junction boxes near each instrument allow access to all the wires, and by means of a many-way switch one instrument can be connected to any other instrument desired. It is necessary, in this system, to replace the switch lever on the common stud.

Automatic Systems.—In the newest telephone systems the return of the circuit to its normal condition, so that it is ready to receive another call, is accomplished automatically when the hand-phone is replaced, at the end of a conversation. The selector switch is used only when calling up. When ringing up, the depression of the bell-push also disconnects the receiver from the 'home line', thereby preventing disturbance from other callers. To receive a call, all that is necessary is to remove the receiver, place it to the ear, and begin the conversation.

The automatic principle has made considerable progress since the beginning of the present century; it remains to be seen whether the principle is applicable on a large scale. Automatic exchanges are in course of erection in many towns, and the experience gained in working these will, no doubt, determine to what extent the automatic exchange can profitably supersede the older system.

Sensitiveness of the Telephone.—Much of the success attained in telephony, and also much of the disturbance experienced by users of the telephone, may be ascribed to the remarkable sensitiveness of both transmitter and receiver. Hughes's microphone is said to be affected by the walking of a fly over it, and it has been stated by Lord Rayleigh that a current of about four hundredths of a microampere can be perceived in the telephone; other observers have given even smaller values for this minimum current.

Long-distance Telephony.—Communication between one town and another takes place over 'trunk' lines, or cables which are laid double in order to prevent inductive disturbances. The British Post Office is gradually laying a network of trunk circuits so that telephonic communication may be made possible between the remotest towns in the three kingdoms. In America the telephone has been used between New York and San Francisco, a distance of about 2500 miles.—Bibliography: F. C. Allsop, *Telephones, their Construction and Fitting*; Preece and Stubbs, *Telephony*; Herbert, *Telephone System of British Post Office*; J. Poole, *Practical Telephone Handbook*; Webb, *The Telephone Service.*

Tel'escope, an optical instrument essentially consisting of a set of lenses, or mirrors and lenses, fixed in a tube or a number of sliding tubes, by which distant objects are brought within the scope of distinct, or more distinct vision. There are two ways in which the telescope may assist human vision. The light entering the pupil of the eye from a luminous body of no appreciable apparent size, and received upon the retina, may be too little to affect sensibly the optic nerve. The telescope substitutes for the human eye its large object lens, or its reflector, which collects and transmits to the eye a larger amount of light in proportion to the area of its light-gathering surface, and this increased light may be adequate to ensure perception. Again, the surface of any object presented towards the unaided eye may be regarded as projected upon a large sphere, having the eye for its centre, and its apparent area is measured by the proportion of the entire surface of that sphere which it would occupy. When the distance is great, this angular area becomes too small to convey to the retina any sensible impression, even if the surface luminosity of the object is considerable. In this case the telescope aids the eye by magnifying the image of the object, so as to bring its angular area above the limit of visibility.

The *refracting telescope* is constructed of lenses which by successive refractions produce the desired effect. In fig. 1, which illustrates this instrument in its simplest form, A and C are two lenses of different focal lengths. The practically parallel rays from a point on a distant object, falling upon the object-glass A, converge to a point at B, in its focal plane. The eye-glass C, placed at about its focal length from B, gathers up the diverging rays and carries them to the eye. Its effect is to magnify the image of the object formed in the focal plane of A (see *Optics*). The magnifying power of the instrument is approximately AB/CB, or the ratio of the focal length of the object-glass to that of the eye-glass. The composite nature of light, and the fact that rays of different colour or wave-length undergo different amounts of refraction, cause the diverse rays falling upon a single lens to converge upon different foci. Thus a blurred and coloured image is produced. Formerly, in order to minimize the *chromatic aberration*, object-glasses were made of great focal length in relation to their diameter. The telescope had thus to be very long and unwieldy. Now the difficulty is overcome by using an object-glass made up of two lenses, a convex lens of crown glass and a concave lens of flint glass (see *Achromatic*). For the same and other reasons the eye-piece also consists of two lenses of one or other of

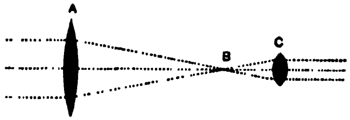


Fig. 1

certain particular forms and arrangements. In the astronomical refracting telescope the object is seen inverted. For observing terrestrial objects this would be unsuitable; therefore when the telescope is so employed, a terrestrial eye-piece containing two additional lenses and giving erect images is used. In the *Galilean telescope* the eye-piece is a concave lens placed so as to intercept the rays from the object-glass before reaching the focus. This gives an erect image, but a small field of view. It is now used practically only for opera-glasses and field-glasses.

The *reflecting telescope* was devised in order to get rid of the trouble of chromatic aberration, and is still found to be a specially advantageous form of instrument for many purposes. In it the object-glass is replaced by a concave mirror. As rays of different colours are not separated by reflection, the image formed by this mirror is free from the colour defect. Fig. 2 shows the structure of the reflecting telescope of the *Gregorian* form. AB is a large speculum perforated in the centre; *ba* and *dc* are two of the rays from a distant object, which are reflected to a focus at *e*. A small concave speculum C, placed slightly beyond the focus *e*, intercepts the reflected rays and sends them towards the central opening at O, where they are received upon an eye-piece. In the *Newtonian* form of reflecting telescope the rays, after reflection from the large speculum, fall upon a flat mirror situated on the telescopic axis and fixed at an angle of 45°. This reflects them to the side of the tube, where the eye-piece is placed to receive them. In the *Herschelian* telescope the speculum is slightly inclined, so that its optical axis makes a small angle with the axis of the telescope tube. The image is thus formed at the open end or mouth of the tube at one side, and is here viewed through an eye-piece, so that the observer has his back towards the object under examination. Formerly the mirrors of reflecting telescopes were made of ‘speculum metal’, a composition consisting of two-thirds of copper and one-third of tin. For the mirrors of modern reflectors a piece of glass is accurately ground to the required shape. Upon the curved front of this is deposited a thin film of silver, which forms the reflecting surface. This has the great advantage that it can be renewed from time to time, without necessitating a repetition of the original figuring process.

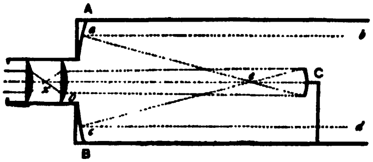


Fig. 2

The Lick and Yerkes Observatories, in the United States, possess the largest refracting telescopes in the world, the diameters of the object-glasses being 36 and 40 inches respectively. At Meudon, Paris, there is a refractor of 32·6 inches aperture. The largest instruments are, however, reflecting telescopes. The Dominion Observatory, Victoria, British Columbia, has a mirror of aperture 72 inches, a size the same as in the famous telescope of Lord Rosse at Parsonstown, in use last century. Mount Wilson Observatory, California, has two reflecting telescopes, the apertures of which are 60 inches and 100 inches.

Telford, Thomas, British engineer, born in 1757 in Eskdale, Dumfriesshire, died in 1834. He was a mason to trade, and worked for some time in Edinburgh, but settled in London in 1783. He proved himself to be a very efficient foreman builder, and in 1787, through the good offices of Sir William Pulteney, who had known him in Dumfriesshire, he was appointed surveyor of public works in Shropshire. He now exchanged his original occupation for that of civil engineer, and was entrusted with the construction of the Ellesmere Canal. In the years 1803 and 1804 the parliamentary commissioners for making roads and building bridges in the Highlands of Scotland, and also those for making the Caledonian Canal, appointed Telford their engineer, and thus an immense amount of work was carried out by him. Above thirty harbours were built or improved by him, some of which, as at Aberdeen and Dundee, were upon an extensive scale. He also superintended the construction of five large bridges over the Severn, and the laying down of the Gloucester and Berkeley, the Grand Trunk, Birmingham and Liverpool, and the Macclesfield Canals. In 1808 he was employed by the Swedish Government to lay out a system of inland navigation through the central parts of that kingdom, which ultimately formed a direct communication by water between the North Sea and the Baltic. The greatest monument of his engineering skill, however, was the Menai Suspension Bridge, connecting Carnarvonshire with the Island of Anglesey, opened in 1826. The Conway Bridge was also built by him, as well as the Dean Bridge, Edinburgh, and the Broomielaw Bridge, Glasgow. He was buried in Westminster Abbey.—Cf. S. Smiles, *Lives of the Engineers.*

Tell, William, a legendary national hero of Switzerland. He is said to have belonged to the canton of Uri, and to have united with others in resisting the Austrians. In particular, having refused to do homage to the hat of the

Duke of Austria, which Gessler, the duke's bailiff, had set upon a pole, he was seized and condemned to death, but granted his life on condition of shooting with an arrow an apple placed on the head of his own son. This he did successfully, admitting at the same time that a second arrow he had was intended for Gessler in case of failure. He was therefore still kept a prisoner; but while being conveyed over the Lake of Lucerne he managed to leap ashore, and soon after, having lain in wait for Gessler, he shot the tyrant dead. The stories professedly belong to the end of the fourteenth or early part of the fifteenth century. The most famous version of the story of Tell is Schiller's drama *Wilhelm Tell*. *Guillaume Tell* is the name of an opera by Rossini.

Tell al-Amarna, an extensive group of ruins on the right bank of the Nile, near Haggi Kandil, 196 miles from Cairo. The name is derived from the Beni Amran, a nomadic tribe of the district, and the *Tell*, meaning 'a hill', is a solecism. Tell al-Amarna is the site of the ancient Egyptian city of Akhetaten, which was founded in 1370 B.C. by Amenhotep IV, the father-in-law of Tutankhamen (q.v.). Amenhotep conceived a violent dislike for Amen-Ra and the whole pantheon of miscellaneous Theban deities with their attendant priesthood, and substituted for the old polytheistic form of worship a monotheistic cult of the sun, which was worshipped as a Disk. Amenhotep changed his name to Akhenaten, or 'spirit of Aten', *Aten* being the Disk of the Sun, and he had the name of Amen and the ideographs of the dual god Amen-Ra chiselled from all temples and monuments, at the same time transferring his capital from Thebes to Akhetaten. Throughout his reign the sun cult persisted, and he died and was buried at Akhetaten, leaving no male heir, but seven daughters, Sakere, the husband of his eldest daughter, succeeding him as king. The reign of Sakere was not long, and on his death Tutankhaten ascended the throne, changed his name to Tutankhamen, and reverted to the old form of worship, deserting Akhetaten for Thebes, and allowing the city of the sun cult to be forsaken and forgotten. Among excavators have been Flinders Petrie (1891), who unearthed the Royal Palace and the Temple of the Disk; the Deutsche Orient Gesellschaft (1910–4); and the Egypt Exploration Society (1920–1).

Tell-el-Kebir′, a village of Egypt, near the railway from Cairo to Ismailia and the Freshwater Canal, where the British troops under Wolseley defeated those of Arabi Pasha, 13th Sept., 1882.

Tellicherry, a seaport of India, in the Malabar district of the province of Madras. It is the third port of Malabar, and is a mart for sandalwood, pepper, and coffee. Pop. 29,370.

Tellurium (symbol, Te; atomic weight, 127·5), a rare element discovered by Klaproth in 1798. It belongs to the sulphur group of elements, and shows a considerable resemblance to sulphur and selenium, although it is usually classed as a metal. It is found in certain gold ores in Transylvania and Hungary, occasionally native, but mostly associated with other elements, for example, in *bismuth telluride* or *tetradymite*, Bi_2Te_3 (California), *lead telluride* or *altaite*, PbTe (America), and in arsenical pyrites. Considerable quantities of tellurium are obtained from the sludge in electrolytic cells in the refining of copper. It occurs in allotropic modifications, a crystalline, brittle form resembling bismuth, and a black amorphous form. The element melts at 450° C., and burns in air, forming tellurium dioxide, TeO_2. The oxides correspond to those of sulphur, e.g. TeO_2 corresponds to sulphur dioxide, SO_2. It forms a gaseous compound with hydrogen, *telluretted hydrogen*, TeH_2, which has an exceedingly unpleasant odour and unites with metals forming *tellurides*, corresponding to the sulphides. All compounds of tellurium when fused with potassium carbonate and carbon, and then treated with water, yield a characteristic purple solution. The atomic weight of tellurium is interesting, as it is higher than that of iodine, although iodine comes after tellurium in the Periodic Table (q.v.).

Telpherage, a system of handling goods in works, and conveying them from one part to another at high speed. In the usual arrangement an electric supply is provided by a trolley wire, or, where permissible, by one of the girders from which the carrier is suspended; and similar equipment is installed for the return of the electricity from the motor to the source of supply. It is one of the most flexible systems of handling any material in bulk or in containers, and admits of great extension. It is not confined in use to any particular industry, for the only changes in design which are needed to adapt it to any type of work are in the form of the carrier, which may be replaced by a grab or crane hook. In ordinary practice light loads are dealt with by a carrier suspended from the bottom flange of an I beam, but heavy loads may necessitate the use of taper strips on the beam, or, in cases where high speeds are essential, the car may be run on tracks suspended from the beam. The system is most satisfactory when arranged in horizontal runs, but small gradients, such as those up to 1 in 50, can be operated successfully. It is preferable to use a direct-current supply, because of the simplicity of the collecting gear and track switches compared with those necessary with alternating currents. If a rail is used for the return, it should be bonded, that is, copper connections across the joints should be provided.

Telu'gu, or **Telinga**, one of the languages of India, belonging to the Dravidian group, and spoken in Southern India by over twenty millions of people. The Telugu are the most numerous branch of the Dravidian race, but are less enterprising than the Tamils. The language is allied in roots to the Tamil language.

Tem'buland, a district of the Cape Province, Union of South Africa. It adjoins Pondoland and Griqualand East; chief town, Umtata. Pop. 234,000.

Temisoara (Mag. *Temesvár*), a town of Roumania, capital of the Banat, in a marshy plain on the Béga Canal. Manufactures include tobacco, matches, leather, beers, &c. From 1552 to 1716 Temisoara was a Turkish town, and passed to Hungary, from which it was separated after the European War. Pop. 72,550.

Tempē, **Vale of**, a beautiful valley of Northern Greece, in Thessaly, on the Peneus, much celebrated by the ancient poets, having Mount Olympus on the north and Mount Ossa on the south.

Temperance Legislation, legal measures for the prevention of intemperance. In 1551–2 there was passed a *Licensing Act* which had as its chief aim the prevention of drunkenness. It regulated and reduced the hours during which liquor might be sold on Sundays, and instituted penalties on innkeepers who permitted upon their premises the playing of games of chance, traffic in stolen goods, and the resorting of idle and notoriously dissolute persons. Another measure on behalf of temperance was the *Gin Act* (1736), the cheapness and popularity of that particular spirit having produced appalling scenes of degradation. The price of gin was raised by increased taxation; but the measure was a failure, and the chief result was a great increase in illicit trade. The *Beerhouse Act*, or *Duke of Wellington's Act* (1830), modified in 1834 and 1840 and repealed in 1869, removed from the control of the local justices houses in which only beer was sold. During the latter half of the nineteenth century all proposed temperance legislation received warm support from, and was largely initiated by, Sir Wilfred Lawson, who was returned to Parliament as member for Carlisle (1859). In 1864 he unsuccessfully introduced his *Permissive Bill*, by which a two-thirds majority in any district would have had the right to local veto. During the European War the autocratic powers acquired by the Government permitted the exercise of a control hitherto unparalleled over the sale of intoxicating liquors, and this was not entirely relaxed after the Armistice. See *Prohibition*.

Temperance Societies. The first association for the purpose of influencing public opinion in order to check the evil of intemperance appears to have been formed in Massachusetts in 1813. A year after its formation similar associations were formed in Connecticut and Vermont. In 1826 a new impulse was given to the movement by the establishment in Boston on a more extensive plan of the American Society for the Promotion of Temperance. By 1831 more than 2200 societies, embracing 170,000 members, were in correspondence with the parent society. In Aug., 1829, a society was formed in Ireland, and in 1838 a great impetus to the movement was given by the Rev. Theobald Mathew, an Irish Catholic priest. The first temperance society in Scotland was established at Maryhill, near Glasgow, in Oct., 1829, and the Greenock and Glasgow and West of Scotland Temperance Societies were constituted soon afterwards. On 14th June, 1830, the first temperance society in England was founded at Bradford. In 1817 a total abstinence society was formed at Skibbereen, County Cork; it was followed by the formation of a similar society in Dunfermline in 1830, and that by others in Paisley, Glasgow, Greenlaw, and elsewhere. In 1832 the war against intoxicating liquors of all kinds was opened in England by Joseph Livesey of Preston. Since then many advocates of total abstinence have sought to enforce their views by legislative measures, as long ago exemplified in the celebrated Maine Liquor Law, for the suppression of the manufacture and sale of intoxicating beverages in the state of Maine. Legislation has since been in favour of compulsory abstinence, especially in the United States (see *Prohibition*). Among the principal temperance societies in Great Britain—besides the world-wide Independent Order of Good Templars, which originated in America—are the National Temperance League, founded in London in 1856; the United Kingdom Alliance (the Permissive Bill party), founded in 1853; the Scottish Temperance League, established in 1844; the Irish Temperance League; the Church of England Temperance Society, organized in 1878; societies in connection with the Established and United Free Churches of Scotland, the Protestant Episcopal Church in Ireland, and with the various Dissenting bodies throughout the kingdom; the Band of Hope Union; &c. Other national societies are principally benefit societies, among the chief of which are the Sons of Temperance, the Independent Order of Rechabites, and the Sons of Phœnix.

Temperature, the state of a body with respect to sensible heat. To say that one body is at a higher (or lower) temperature than another is the same thing as to say that the first body is hotter (or colder) than the other. Since many physical phenomena take place at definite temperatures, it would be quite possible to construct a scale of temperatures containing no very wide gaps, and marked with such definite points as the melting- and boiling-points of standard substances under stated pressures. It is found more convenient, however, to define a continuous scale, based on some physical property which varies continuously as the temperature changes. See *Thermometer*; *Pyrometer*; *Thermodynamics*; *Climate*; *Meteorology*.

Templars, a military Order which played a large part in European history in the twelfth and thirteenth centuries. It was founded in 1119 to guard the holy places, and its name was derived from its first house in Jerusalem, on the site of Solomon's Temple. The members were sworn to chastity, poverty, and obedience, and their vows might be taken for life or for a period of years. The head of the Order was the Grand Master, and, as it spread from country to country, Masters, Grand Priors, Preceptors, or Commanders were placed in charge of the various provinces. The Templars were exempted in 1172 from obedience to the bishops of their dioceses, and were placed under the direct authority of the Pope. The dress of the Order, worn by the Knights (though not by the lesser ranks of men-at-arms and retainers), was a white linen mantle with a red cross on the left shoulder. Its statutes, originally drawn up in 1128, forbade luxury in food or drink, and such sports as hunting and hawking. The Templars played a distinguished part in the Crusades, and it is said that 20,000 of them met their death in Palestine. They became numerous and wealthy, and, as early as the second quarter of the thirteenth century, grave charges were brought against them. The popular impression of their pride, lust, and rapacity is described (and perhaps somewhat antedated) by Scott (*Ivanhoe*). After the close of the active period of the Crusades, the Order ceased to have any *raison d'être*, and its wealth and privileges roused jealousy and ill will. Its suppression was one of the most remarkable episodes in the history of the fourteenth century. Philip IV of France resolved to enrich himself with their possessions, and he obtained the consent of Pope Clement V, whom he had placed on the Papal throne. The French Templars were arrested on 13th Oct., 1307; many of them were put to the torture, and evidence of outrageous heresies and grave moral offences was extracted from some of them. In 1808 Clement ordered the Templars in every country of Europe to be subjected to an interrogation, accompanied by torture. The proceedings were marked in France by great cruelty. A General Council was summoned to meet in Vienne to consider the results of the investigation, but Clement ultimately condemned the Order out of hand by Bulls, *Vox in excelso* and *Ad providam*, issued in 1812. Strong Papal pressure was used to obtain a condemnation in England; and in Spain, Portugal, Germany, and the greater part of Italy the decision of the investigators was in favour of the Order. The suppression was, however, universal, and much of the property of the Templars passed to the military Order of the Hospitallers of St. John of Jerusalem, though, in France, Philip IV secured considerable gains. The memory of the Templars is preserved in numerous place-names. The question of their guilt is one of the puzzles of history, and has given rise to a vast amount of literature, but, on the whole, discussion tends to the exculpation of the Order.—BIBLIOGRAPHY: C. G. Addison, *History of the Knights Templars*; H. C. Lea, *History of the Inquisition*, vol. iii.

Temple, Frederick, British prelate, born in 1821, died in 1902. Educated at Tiverton and Balliol College, Oxford, he became a Fellow of his college. He took orders in 1846, was appointed principal of Kneller Hall Training College in 1848, and in 1858 became headmaster of Rugby School. Appointed Bishop of Exeter in 1869, in spite of great opposition, he was transferred to the see of London, and in 1896 succeeded E. W. Benson as Archbishop of Canterbury.

Temple, Sir William, English statesman, born in 1628, died in 1699. Educated at Emmanuel College, Cambridge, he passed six years abroad, and in 1660 he was nominated as one of the commissioners from the Irish Parliament to the king, subsequently (1666) being appointed Resident at Brussels, and receiving a baronetcy. In conjunction with De Witt he concluded the treaty between England, Holland, and Sweden (Triple Alliance, 1668), as a result of which France had to surrender her conquests in the Netherlands. After representing the University of Cambridge in Parliament, Temple retired from public life (1681), spending his life at Moor Park, Surrey, where Swift was an inmate of his house for some time. His *Memoirs and Letters* are especially interesting to the student of history. His *Miscellanies* consist of essays on various subjects, mostly political; he was the author of an essay *Upon the Ancient and Modern Learning*, which gave rise to the celebrated controversy about the *Letters* of Phalaris. See *Bentley*.—Cf. M. L. R. Beaven, *Sir William Temple* (Gladstone Essay, Oxford, 1908).

Temple (Lat. *templum*), in architecture, a building designed for the performance of public worship. Magnificent temples were erected in ancient Greece and Rome, the Romans taking the Greek structures for models. (For description of Grecian temples, see *Greece.*) The Egyptian temples were also remarkable structures. (See *Egypt.*) The most remarkable temple in the world, however, was that built by Solomon on Mount Moriah in Jerusalem. It was an oblong stone building, 60 cubits in length, 20 cubits in width, and 30 cubits in height. On three sides were corridors, rising above each other to the height of three stories. The fourth or front side was open, and was ornamented with a portico, 10 cubits in width, supported by two brazen pillars. The interior was divided into the most holy place, which contained the ark of the covenant, and was separated by a curtain from the sanctuary, in which were the golden candlesticks, the table of the shew-bread, and the altar of incense. The temple was surrounded by an inner court, which contained the altar of burnt-offering. Colonnades, with brazen gates, separated this court of the priests from the outer court, which was likewise surrounded by a wall. This temple was destroyed by the Assyrians, and, after the return from the Babylonian captivity, a second temple, but much inferior in splendour, was erected. Herod the Great rebuilt it of a larger size, surrounding it with four courts, rising above each other like terraces, the lowest of which was 500 cubits square, and was surrounded on three sides by a double, and on the fourth by a triple row of columns. In the middle of this enclosure stood the temple, of white marble richly gilt, 100 cubits long and wide, and 60 cubits high, with a porch 100 cubits wide. This magnificent edifice was destroyed by the Romans in A.D. 70. See *Pantheon*; *Parthenon.*

Temple, The, a district of the city of London, lying between Fleet Street and the Thames, and divided by Middle Temple Lane into the Inner and the Middle Temple, belonging to separate societies (see *Inns of Court*), each with its hall, library, and garden. The name is derived from the Knights Templars, who had their headquarters in England here. The district, which is extra-parochial, being exempt from the operation of the poor law, is occupied, with few exceptions, entirely by barristers and solicitors.

Temple Bar, an arched gateway which formerly stood between Fleet Street and the Strand in London and divided the City from Westminster. It was removed (1878), and re-erected at Theobalds Park, Cheshunt, in 1888.

Templet, a pattern or mould used by masons, machinists, smiths, shipwrights, &c. It usually consists of a flat thin board, a piece of sheet-iron, or the like, whose edge is dressed and shaped to the required conformation, and is laid against the object being moulded, built, or turned so as to test the conformity of the object thereto.

Temryuk, a port of Ciscaucasia, in Kuban. Pop. 17,700.

Tenant, in law, one who occupies, or has temporary possession of lands or tenements, the titles of which are in another, the landlord. A *tenant-at-will* is one who occupies lands or tenements for no fixed term other than the will of the landlord. A *tenant in common* is one who holds lands or tenements along with another or other persons. Each share in the estate is distinct in title, and on the death of a tenant his share goes to his heirs or executors. A *tenant for life* (in Scotland, a *liferenter*) is one who has possession of a freehold estate or interest, the duration of which is determined by the life of the tenant or another. An estate for life is generally created by deed, but it may originate by the operation of law, as the widow's estate in dower, and the husband's estate by courtesy on the death of his wife. See *Landlord and Tenant.*

Tenant-right, a term specifically applied to an Irish custom, long prevalent in Ulster, either ensuring a permanence of tenure in the same occupant without liability to any other increase of rent than may be sanctioned by the general sentiments of the community, or entitling the tenant of a farm to receive purchase-money amounting to so many years' rent, on its being transferred to another tenant; the tenant having also a claim to the value of permanent improvements effected by him. In course of time the advantages of tenant-right granted to the Ulster farmers were claimed by the farmers in the other provinces of Ireland, and the custom spread to a considerable extent. At last the Landlord and Tenant Act of 1870 was passed, by which the Ulster tenant-right and other corresponding customs received the force of law; and the outgoing tenant became entitled to compensation from the proprietor to an amount varying according to circumstances. The tenant's position was further improved by the Land Law Act, 1881, and subsequent Acts. (See *Ireland.*) In Great Britain also the position of agricultural tenants has been improved by legislation, more particularly by the Agricultural Holdings Act of 1908 (consolidating earlier statutes), which assures tenants of certain customary rights and expressly adds others, especially the right of compensation for definite improvements made in their holdings.

Tenas'serim, a maritime division of Lower Burma, conterminous on east and south with Siam and Malaya respectively. There are six districts, viz. Toungoo, Salween, Thaton, Amherst, Tavoy, and Mergui. Area, 36,076 sq.

miles; pop. 1,406,260 (mainly Buddhists). The adjacent islands of the Mergui Archipelago belong to the division. Moulmein is the headquarters.

Tenby, a municipal borough and seaport of Wales, in the county of Pembroke, on the west side of Carmarthen Bay. There is a considerable trade in fish and oysters, and Tenby is also a bathing-place, celebrated for its fine sands, beautiful scenery, and agreeable climate. The old walls of the town are still to some extent preserved. Pop. 4800.

Tench, a teleostean fish belonging to the carp family and genus Tinca, of which *T. vulgāris* (the common tench) is the type. It inhabits most of the lakes of the European continent, and in Britain it is frequent in ornamental waters and ponds. It attains a length of from 10 to 12 inches. The colour is generally a greenish-olive above, a light tint predominating below. It is very sluggish, apparently inhabiting bottom-waters, and feeding on refuse vegetable matter. It is very tenacious of life, and may be conveyed alive in damp weeds for long distances. The flesh is somewhat coarse and insipid.

Tender, in law, an offer of compensation or damages made in a money action. To make a tender valid it must be absolute and unconditional, and the money must be actually produced. A tender made to one of several joint claimants is held as made to all. A tender of money for any payment is legal, and is called a *legal tender* (q.v.), if made in current coin of the realm.

Tendon, the name given to the 'sinews' by means of which muscles are inserted upon bones. They consist of bundles of white fibrous inelastic and very strong tissue disposed in bands, and separated by areolar or connective tissue. See *Achilles' Tendon.*

Teneb'rio, a genus of beetles. The larvæ of one species (*T. molitor*) are the destructive mealworms of granaries, flour-stores, &c.

Ten'edos, a Greek island in the Ægean Sea, on the west coast of Asia Minor, 15 miles southwest of the Dardanelles, about 6 miles long and 3 miles broad. The channel which separates it from the mainland is 3 miles broad. Corn, cotton, wine, and fruits are produced. On the eastern side of the island is the town of Tenedos. Under the Treaty of Sèvres, Tenedos passed to Greece. Pop. 4000.

Teneriffe', the largest of the Canary Islands (q.v.); area, about 780 sq. miles. Santa Cruz is the island and group capital. A remarkable feature of the interior is the Peak, the summit of which forms a crater half a league in circuit, and from which is obtained one of the most magnificent views in the world. The principal productions are: maize, wheat, potatoes, tomatoes, bananas, almonds, oranges, guavas, honey, wax, cochineal, and wine. Tomatoes, bananas, potatoes, and wine are the chief exports. Pop. 180,000.

Tenes'mus, continued painful efforts to empty the rectum or the bladder, produced by spasmodic contractions of these organs. The rectal condition may occur as the result of piles, fissure, fistula, or tumour growths. Tenesmus of the bladder arises in cases of stricture of the urethra, and of stone or growth in the bladder, or any inflammatory condition in the region of the bladder.

Teniers (ten-ērs'), David, the name of two artists of the Flemish school, father and son, both natives of Antwerp, in which city the elder was born in 1582, and died in 1649. Having studied under Rubens, he spent six years in Rome. On his return he occupied himself principally in the delineation of fairs, rustic sports, and drinking parties, which he exhibited with such truth, humour, and originality that he may be considered the founder of a style of painting which his son afterwards brought to perfection. His pictures are mostly small.—His son was born in 1610, and died in 1690. He was taught painting by his father, whom he excelled in correctness and finish. He became highly popular, was appointed court painter to the Archduke Leopold William, Governor of the Netherlands, and gave lessons in painting to Don John of Austria. He specially excelled in outdoor scenes, though many of his interiors are masterpieces of colour and composition. His general subjects were fairs, markets, merrymakings, guard-rooms, taverns, &c., and his pictures, which number over 700, are found in all the important public and private galleries of Europe. *The Village Fête* (Fête aux Chaudrons) is in the National Gallery, London, and *Peasants dancing before an Inn* is in the Louvre. His etchings are also highly esteemed.

Tennessee, a south-central state of the United States. It is physically diverse, the surface varying from the traversing ranges of the Appalachians in the east, through the Cumberland Plateau and the plains of the Rim lands, to the Western Valley and the Plateau of West Tennessee, which abuts on the low, flat, alluvial plains (bottom-lands, 900 sq. miles in area) of the Mississippi River (the western boundary of the state). The chief rivers are the Mississippi, the Cumberland, and the Tennessee, all navigable throughout their length; the last two drain over three-quarters of the state. Climatically, Tennessee is exceptionally favoured; along a line through the centre of the state the mean annual temperatures are: east, 57° F., middle Tennessee, 58° F.; and west, 59° F. Nashville is state capital; other cities are Memphis, Knoxville, and Chattanooga, all ports of entry. Railways (see *Nashville*) include the Southern and the Cincinnati Southern. Tobacco is one of the chief crops; cotton is important; cereals include maize (the chief) and wheat; fruit (strawberries largely) and fruit trees are grown; and stock-raising is fairly wide, though declining, but the annual wool-clip is notable. Forestry is important. Among minerals, the state produces coal from coal-fields of 4000 sq. miles in area, with an annual production of over 6,000,000 tons. Gold, copper, zinc, and marble are also worked. Manufactures are exceedingly varied, and include the working of iron and steel; but generally they are subordinate to agricultural requirements. The people are predominantly white, and 40 per cent are of the Baptist faith, another 33 per cent being Methodist. Foreign-born people are represented mainly by Germans, English, and Irish (in order of importance). Elementary education is compulsory up to fourteen years, and the colour-line is rigid. There are twenty-six universities and colleges, including the State University at Knoxville, founded in 1794. The state area is 42,022 sq. miles (335 being water); pop. (1920), 2,340,000.

Tennessee joined the Union on 1st June, 1796, and has a Governor and bicameral Assembly (Senate of 33 members, and House of Representatives of 99 members, both elected biennially). Two Senators and ten Representatives are sent to Congress. There are ninety-six counties. (See articles on cities mentioned.)

Tennessee, a river of the United States, formed by the union of the French Broad and Holston Rivers in Eastern Tennessee, flows through Northern Alabama, then through Western Tennessee and Kentucky, and enters the Ohio, of which it is the largest tributary, about 10 miles below the confluence of the Cumberland. Length, about 650 miles; catchment basin, 44,000 sq. miles. It is navigable throughout its entire course during most of the year, and the chief tributaries are also navigable.

Tenniel, Sir John, British artist, born in London in 1820, died in 1914. He was almost entirely self-taught, and his first picture was exhibited while he was little more than a boy. He devoted himself almost entirely to black-and-white work. In 1851 he became connected as an illustrator with *Punch*, and for fifty years contributed illustrations to that paper, especially the weekly political cartoon. He also illustrated various books, including *Æsop's Fables*, *Ingoldsby Legends*, *Alice's Adventures in Wonderland*, &c. He was knighted in 1893.

Tennis, an ancient ball game, for long the pastime of royalty and the nobility. Its devotees included Henry VIII and Charles II, who were expert players, and in France there were many courts, Paris alone having a hundred and fourteen in 1657, as against fifteen in London in 1615. Tennis-courts are specially constructed buildings, and are somewhat complicated. The game itself is fairly difficult to learn, and beyond the power of many to play well. The court is divided into *service* and *hazard* sides separated by a net; balls of between 2¼ and 2⅝ inches in diameter and 2½ to 2¾ oz. in weight are used, and heavy rackets are employed, without restrictions as to size or shape. With two players X and Y, X, standing in the service end, hits off the ball on to the *service-penthouse*, and the ball must drop eventually in the service-court. Should X fail to perform this feat, it constitutes a *fault*, and two of them make one point, scoring 15. (Four points—15, 30, 40, game—are usually played.) The game develops into a contest of keeping the ball ' off the floor ', but chaces and other exceedingly complicated rules and devices stimulate a lively interest as play progresses.—Cf. *Tennis* (in the Badminton Library); but tennis cannot be understood readily from a formal perusal of a textbook; courts must be visited, and games watched carefully.

Tennyson, Alfred, the representative poet of Victorian England, was born in 1809, and died in 1892. He was the fourth son of the rector of Somersby, in Lincolnshire. His two elder brothers, Frederick and Charles, were also poets of some distinction. Educated at Louth Grammar School and by his father, Tennyson joined, at Trinity College, Cambridge (1828), a band of able young men, which included his greatest friend, Arthur Henry Hallam. In 1827 Tennyson's earliest verses, echoes of Scott, Byron, and Moore, with individual touches of vivid description, appeared in *Poems by Two Brothers*. His first original verses were issued as *Poems, chiefly Lyrical* in 1830, followed by *Poems* in 1833. The poems in these volumes were very unequal, and many of them underwent in successive appearances a process of elaborate revision, while others were rejected. The result of this severe discipline, of the unwearied effort to secure by vividness of presentation, significant detail, a clear flute-like melody of vowel and consonant, the perfect expression of the mood of which each poem was a rendering, is evident in the two volumes of 1842, *Poems by Alfred Tennyson*. Like Spenser, Tennyson is most delightfully a poet in poems that strive to be no more than decorative and musical renderings of a dreamy mood. *Recollections of the Arabian Nights*, *The Dying Swan*, *The Lady of Shalott*, *Mariana*, *The Lotos Eaters*, *The Talking Oak*, *Sir Lancelot and Queen Guinevere*, these are poems which only he could have written, and are as secure against changes of fashion as the

Prothalamion or the *Il Penseroso*. But the dramatic, the philosophic, and the didactic spirit was moving Tennyson to produce poems of varying merit: dramatic studies, as the now perfected *Œnone*, *Galahad*, and *St. Agnes's Eve*, the *Morte d'Arthur* (first prelude of the *Idylls of the King*), *St. Simeon Stylites*, *Ulysses*, in which Tennyson's finished art is given a deeper emotional quality; metaphysical poems, like *The Two Voices* and *The Vision of Sin*, the latter not more characteristic of Tennyson's fundamental thought and hope than of his curious metrical felicity. In others, as *Locksley Hall* and the *English Idylls*, Tennyson's art is used to embroider themes inspired by a vein of sentiment more Victorian than perennial.

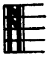
Tennyson's range of topics is fully represented in the 1842 volumes—studies of moods, English rural life, mediæval romance, classical legend, the mysteries of life and death and immortality. His later poems are a fuller elaboration of these, with an art that tends to grow more precious, and in a spirit which grows more didactic. *The Princess* (1847–51–3) is a *jeu d'esprit* elaborated and brocaded out of all proportion to the theme, but adorned with some of the loveliest of Tennyson's highly sophisticated lyrics, notably the finely wrought unrhymed "Tears, idle tears". *In Memoriam* (1850, but the work of many years) expresses in a poem of one hundred and thirty-two sections, each the rendering of a single mood, Tennyson's sorrow for the death of a friend and his broodings over death and the problems of modern science. The thought of the poem makes less appeal to-day than the beauty of the felicitous stanza and of individual sections rendering sombre moods and lovely landscapes. The *Ode on the Death of the Duke of Wellington* (1852) and *Maud and Other Poems* (1855) are other striking examples of Tennyson's command of metrical effects and his power of adapting his varying cadences to changes of mood. But the great work of Tennyson's middle years was the *Idylls of the King*, published in batches from 1857 onwards till 1885. In a style of chiselled, polished, jewelled exquisiteness the poet told a series of stories from Malory's *Morte d'Arthur* and Lady Guest's *Mabinogion* (translations from the Welsh) of Arthur and his Knights and the quest of the Holy Grail, in which he strove, not altogether successfully, to modify the chivalrous Catholic spirit of the originals by the infusion of a modern, vaguely religious, philanthropic, and somewhat maidenly sentiment. Their enormous popularity in their own day has yielded to a depreciation which fails to do justice to their wonderfully varied and finished art. *Enoch Arden* (1864), a simple story that Crabbe might have told in his bare manner and creaky verse, is decorated with all the resources of Tennyson's blank verse and coloured description. His dialect poems *Northern Farmer, Old Style* and the same *New Style* are happier renderings of rural themes.

In his last years Tennyson, under the influence of a poignant sense of disillusionment and of discontent with the age of science and 'progress' whose advent he had hailed, shook off this tendency to over decoration and wrote some poems of a direct and piercing power, which, with his early coloured and musical renderings of dream and mood, are likely to outlive his more ambitious pieces. The dramas *Queen Mary* (1875), *Harold* (1877), *Becket* (1884), &c., hardly count; but *Lucretius* (1868), *The Revenge: a Ballad of the Fleet* (1878), *Ballads and Other Poems* (1880), *Tiresias and Other Poems* (1885), *Locksley Hall Sixty Years After* (1886), *Demeter and Other Poems* (1889), *The Death of Œnone* (1892) included poems that show a weakening grasp and something of an hysterical vein, but also some which are the finest expression of Tennyson's fierce patriotism, his passionate sympathy with certain characters and moods, and his brooding preoccupation with the destiny of man wandering between faiths which are rooted in fear, and science that threatens to dispel hope as well as fear. His closing strains, *Crossing the Bar* and

> "Will my tiny spark of being wholly vanish in your deeps
> and heights",

mark the Stoic-Christian spirit in which he faced the final trial. Tennyson was raised to the peerage in 1884, and died, pre-eminent among the poets of Victorian England, in 1892. The reaction against Tennyson's finished musical art is not unlike that which Donne and Jonson led against the mellifluous diffuseness of Spenser; and, despite obvious differences, Spenser and Tennyson occupy somewhat of the same rank among English poets, not the very highest, because of a certain lack of intensity and insight, yet surpassed by few in their mastery of all the picturesque and musical capacities of our language.—BIBLIOGRAPHY: Hallam, Lord Tennyson, *Alfred Lord Tennyson: a Memoir*; S. A. Brooke, *Tennyson: his Art and Relation to Modern Life*; W. M. Dixon, *A Primer of Tennyson*; A. Waugh, *Alfred, Lord Tennyson: a Study of his Life and Work*; W. Bagehot, *Literary Studies*.

Tenor, in music, is the more delicate of the two adult male voices, and its compass generally extends from C in the bass to G or A in the treble. The qualities of the tenor render it suitable to the expression of tender and delicate sentiments. In a vocal composition of four parts the tenor forms the second middle part, deeper than alto, but higher than the bass; but in the song of four male voices the tenor, as the first voice, leads the chief melody, and as the second is the higher middle voice. The clef of this voice is the C clef, placed upon the fourth line of the staff, as here shown.



Tentacle, in zoology, an elongated appendage belonging to the head or mouth end of many of the lower animals; used as an organ of touch and sometimes of prehension. Examples are afforded by hydroid zoophytes, jelly-fishes, sea anemones, moss polypes, and lamp-shells. The term is also applied to the feelers of snails and slugs, the sucker-bearing arms of cuttle-fishes, and the barbels of certain fishes.

Ten′terden, a municipal borough and market town in the county of Kent, England. Pop. (1921), 3438.

Tenuiros′tres (slender-beaked), one of the four artificial sections into which Cuvier divided perching birds; now only used in popular works. This group, represented by the humming-birds, creepers, sun-birds, hoopoes, &c., is characterized by the generally elongated bill, which usually tapers to a point.

Tenure is the general name for the conditions on which land is held and enjoyed. There are two main systems of land tenure—allodial and feudal. Land held by the former tenure is free of the rights of any superior. It is land held in absolute ownership. It was common in England prior to the Norman Conquest, but was then almost wholly superseded by feudal tenure. Crown lands are, of course, still allodial. In feudal tenure the person who has the beneficial use and enjoyment of the land (the tenant or vassal) renders some specified service (or in modern times pays a rent or duty) therefor to the superior or lord from whom he received the grant or of whom he holds it. The theory introduced at the Conquest was that all land belonged to the sovereign. Grants were made by the king to his great lords on condition of performing certain services, while they in turn made subgrants to their own retainers on similar conditions. In relation to the king they were tenants-in-capite or tenants-in-chief, while in relation to these retainers they were mesne (middle) lords. The retainers, who had the profitable use (or 'avail') of the land, were known as 'tenants paravail'. The highest tenure was knight-service or tenure in chivalry. The lord did homage and swore fealty for his lands. Mounted and armed as a knight and attended by his men-at-arms, he was bound to render military service to the king for forty days in each year if required, and he was also liable for various incidental dues. Another honourable tenure was grand serjeanty; by virtue of which the service to be rendered was not general military service, as in tenure in chivalry, but a special act, e.g. to carry the king's banner or his sword. There were also other forms, but in 1660 most feudal tenures were converted into free and common socage. Frankalmoign, copyhold, and grand serjeanty remained. Two ecclesiastical tenures survived the Conquest—'frankalmoign' (free alms), under which religious houses held lands in return for prayers, and 'tenure by divine service', e.g. the singing of masses, the distribution of alms, &c. See *Copyhold*; *Socage*; *Land Laws*; &c.

Teocallis ('houses of God'), the name given to the ancient temples of Mexico, of which there are extensive remains. They were generally solid four-sided truncated pyramids, built terrace-wise, with the temple proper on the platform at the summit. They were constructed of earth, faced with brick, and many still remain in a more or less perfect state. The principal existing specimens are those of Cholula, near Mexico, and of Palenque, in Yucatan.

Tepic, a maritime territory of Mexico, on the Pacific Ocean, also known as Nayarit (q.v.).

Tepic, a town of Mexico, capital of the territory of Nayarit, connected by rail with the port of San Blas. Its manufactures include woollens, cottons, cigarettes, and sugar. Pop. 16,778.

Teplitz, Töplitz, or **Teplice-Sanov**, a town of Northern Bohemia, Czecho-Slovakia. It has celebrated thermal baths. The springs have a temperature varying from 99·5° to 108·5°, and are efficacious in cases of gout and rheumatism. Pop. 25,000.

Ter′amo, the northernmost province of Abruzzi e Molise, Middle Italy. Area, 1060 sq. miles; pop. 320,000.

Teramo, a city of Southern Italy, capital of the province of Teramo. It is the see of a bishop, and has remains of Roman baths and theatre. Pop. (commune), 25,070.

Ter′aphim, household deities or images, reverenced by the ancient Hebrews. They seem to have been either wholly or in part of human form and of small size, were regarded as *penates* or household gods, and in some shape or other used as domestic oracles. They are mentioned several times in the Old Testament.

Terbium, one of the rare earth metals; atomic weight, 159·2; atomic number, 65. See *Erbium*.

Terborch (earlier Terburg), Gerard, Dutch painter, born about 1617, died in 1681. He studied under his father and at Haarlem, and afterwards visited Germany, Italy, Spain, England, and France. His painting of the peace congress at Münster (1646) is in the National Gallery, London.

Terce is a legal life-rent amounting to one-third of her deceased husband's heritable property (including heritable securities) in which he died infeft, recognized by the law of Scotland in favour of a widow who has not accepted of any special provision.

Terceira (ter-sä'i-rȧ), a Portuguese island of the Atlantic, one of the Azores; area, 223 sq. miles. Grains, cattle, some fruit, and inferior wine are produced. Angra, or Angra do Heroismo (q.v.), is the capital. Pop. 49,000.

Ter'ebinth, the common name for various resinous exudations, both of a fluid and solid nature, such as turpentine, frankincense and Burgundy pitch, Canada balsam, &c. The volatile oil of various of these resins is called oil of terebinth, or oil of turpentine. Terebinth is also a name for the turpentine tree (q.v.).

Terebratula (ter-ē-brat'ū-la), a genus of deep-sea lamp-shells (Brachiopoda) found moored to rocks, shells, &c. The lower valve is perforated to permit the passage of a fleshy peduncle, by means of which the animal attaches itself. There are few living species, but the fossil ones are numerous, and are found most abundantly in the secondary and tertiary formations.

Terek, a river of Ciscaucasia, rising in Mount Kazbek and flowing past Vladikavkaz to the Caspian Sea, which it enters by a delta 60 miles wide. The Zunzha is the chief affluent; length, 382 miles (112 miles navigable).

Terek, a former Russian province of Ciscaucasia, belonging to the drainage system of the Terek River. Vladikavkaz is the capital; Mozdok (pop. 15,000), Georgievsk (11,900), Kislyar (10,000), and Kislovodsk (5000) are other towns. Area, 23,531 sq. miles; pop. 1,230,000.

Ter'ence (Publius Terentius Afer), Roman comic dramatist, was born about 195 B.C., and died about 159 B.C. He is said to have been born at Carthage, and to have been brought to Rome as a slave. He was soon set free by his master, Terentius Lucanus, whose name he took. His literary talents gained for him admission to the circle of Scipio Africanus the younger, where he met Lælius, Furius Philus, and Polybius (q.v.), the historian. Terence's six comedies were written with great care. He appears to have shown his work while in process of composition to Scipio and his friends, and to have revised it meticulously in accordance with their suggestions. According to literary gossip of a later date, Scipio wrote the plays in their entirety; but this ancient counterpart of the Baconian theory is quite untenable. The six plays of Terence in order of their production are: *The Maid of Andros* (166 B.C.), *The Mother-in-law* (165), *The Self-Tormentor* (163), *The Eunuch* (161), *Phormio* (161), and *The Brothers* (161). All these plays are adaptations from the Greek, *The Mother-in-law* and *Phormio* being based on plays of Apollodorus of Carystus, and the other four being founded on Menander. In most of the plays Terence has combined two or more Greek plays to form one Latin one—a process known by the name of *contaminatio*. After producing these plays, Terence went to Greece in order to study Greek comedy at closer quarters. He was said to have translated over a hundred of Menander's comedies, but probably he merely made excerpts for future use. He never returned to Italy. According to some accounts, he was drowned at sea; according to others, he died of a broken heart after losing all his translations in a storm at sea.

The comedies of Terence have several good qualities and many defects. Their language is extremely pure, and they are written with an ease which is only paralleled in English by that of the plays of Congreve. They are in every way polished works of art, and are notable among Latin writings as possessing an Hellenic perfection. They have supplied posterity with several apt quotations, such as

> Amantium irae amoris integratio est.
>
> Hinc illae lacrumae.
>
> Homo sum: humani nil a me alienum puto.
>
> Quot homines, tot sententiae.
>
> Dictum sapienti sat est.
>
> Nullum est iam dictum quod non sit dictum prius.

Terence has, however, purchased his polished repression at the expense of energy—that *vis comica* of which Julius Cæsar lamented the absence. There is a lack of variety in his work. His plays are too close an imitation of the Greek. It is inevitable to compare Terence with Plautus, and almost inevitable to prefer the latter. Plautus, though he based his plays on Greek models, was often highly original, and introduced distinctively Roman touches. Terence was an adapter and a polished stylist pure and simple. Plautus was a popular dramatist; Terence wrote for the aristocracy, and adopted towards the groundlings something of that truculent attitude which is so unpleasant a feature in Ben Jonson. We cannot join Terence in blaming the multitude for going astray after boxers, tight-rope walkers, and gladiators. The comedies of Terence, however, with their perfect workmanship and their cosmopolitan outlook, exercised a salutary influence not only on Latin literature, but on European comedy after the Renaissance.—BIBLIOGRAPHY: J. W. Duff, *A Literary History of Rome*; W. L. Collins, *Plautus and Terence* (Ancient Classics for Modern Readers Series); J. Sargeaunt, *Terence* (Loeb Classical Library); S. G. Ashmore, *The Comedies of Terence* (text and notes).

Terlizzi (ter-lit'sē), a town of Apulia, South Italy, in the province of Bari. Pop. 22,874.

Ter'mini Imerese (**ancient Thermæ Himerenses**), a seaport-town of Sicily, in the province of Palermo, near the mouth of the River Termini on the Tyrrhenian Sea. Corn, oil, olives, and other products of the district are exported, and there is an active fishing industry. It is a spa with thermal saline baths of 106° F. Pop. 20,319.

Termites (ter'mits), a family of neuropterous insects, also known by the name of *white ants*. They have little affinity with the true ants, which are hymenopterous, although they resemble them in their mode of life. They are chiefly confined to the tropics, and are found very plentifully in Western Africa. They unite in societies, building their dwellings in the form of pyramids or cones, 10 or 12 feet high. These dwellings, which are so firmly cemented as to be capable of bearing the weight of three or four men, are divided off into several apartments as magazines, chambers, galleries, &c. Every colony of termites consists of a king and queen, both of which are much larger than the other members of the colony, and of workers and soldiers without wings. The king and queen are the parents of the colony, and are constantly kept together, attended by a detachment of workers, in a large chamber in the heart of the hive, surrounded by stronger walls than the other cells. The queen is always gravid, the abdomen being enormously distended with eggs, which, as they are dropped, relays of workers receive and convey in their mouths to the minor cells throughout the hive. At the beginning of the rainy season a number of winged insects, both male and female, are produced. These, when mature, leave the hive and fly abroad, afterwards shedding their wings, and becoming the kings and queens of future colonies. The soldiers and workers, both neuter, or of no fully developed sex, and differing merely in the armature of the head, are distinct animals from the moment they leave the egg, the young differing from the adult of the same class only in size. The duties of the workers are to build the habitations, make covered roads, nurse the young, attend on the king and queen, and secure the exit of the mature winged insects, while to the soldiers, whose mandibles are powerfully developed for that purpose, is committed the defence of the community, which duty they perform systematically and with desperate courage. There are many species of termites, all of which are extremely destructive to wood.

Dwelling of Termites

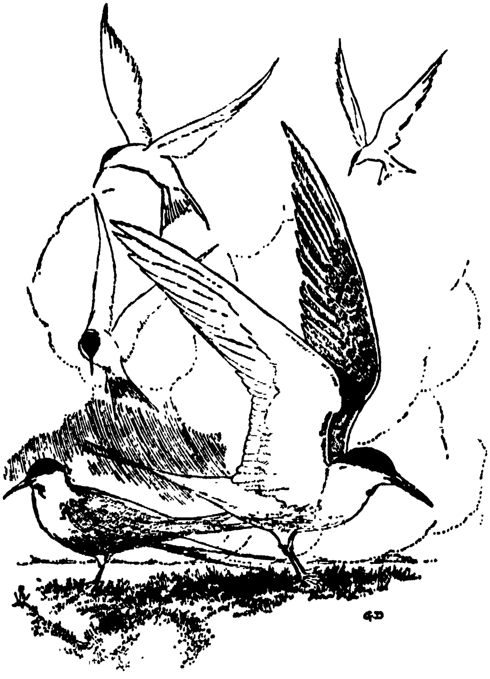
Terms, periods or times connected with law courts, universities, &c. In England the law terms, or periods when the superior courts sat, up to 1873 were four, viz. Hilary term, beginning on 11th and ending on 31st January; Easter term, beginning 15th April and ending 8th May; Trinity term, beginning 22nd May and ending 12th June; Michaelmas term, beginning 2nd and ending 25th November. The rest of the year was termed *vacation*. The law terms are now superseded by 'sittings', though they partly survive in connection with dinners at the Inns of Court. For terms in universities, see *Cambridge*; *Oxford*; *&c.*; for money terms, see *Quarter-days*.

Tern (*Sterna hirundo*), or **Sea-swallow**, a genus of birds, included in the gull family. The terns are distinguished by the long, slender, and straight bill, long and pointed wings, and forked tail. The legs are relatively shorter than in the gulls. The common tern or sea-swallow (*S. fluviatilis*) is a familiar visitant of British coasts. It is a very active bird, seeming to have a ceaseless flight, and feeding upon small fishes. Its average length is 15 inches. The colour is black on the head and neck, and ashy grey on the upper parts generally. The under parts are white, the legs, feet, and bill being red. This species is native to Europe, temperate Asia, temperate North America, and, as a migrant, in Southern Asia, Southern Africa, and Brazil.

Ternate, one of the Molucca Islands (q.v.); area, about 25 sq. miles. It contains a remarkable volcano (5600 feet), and produces tobacco, cotton, sago, sulphur, saltpetre, &c. The town Ternate is the seat of a native sultan and of the Dutch Resident. Pop. about 9000.

Terni (**ancient Interamna Nahars**), a city of Perugia, Middle Italy, on the Nera (ancient *Nar*). It has a cathedral (1653, architect Bernini), several other churches, and some Roman antiquities (remains of an amphitheatre, &c.). Near by are the Velino Falls (650 feet in three leaps), formed by the Romans to drain the *Lacus Velinus* (below Reate). They are now used to generate power for factories at Terni, where armour-plate, guns, rails, and machinery are made. Pop. (commune), 82,750.

Ternstrœmia′ceæ, a natural order of polypetalous dicotyledonous plants, consisting of trees or shrubs, with alternate simple usually coriaceous leaves without stipules. The flowers are generally white, arranged in axillary or terminal peduncles, articulated at the base. This order is one of great economical importance, as it includes the genus Thea, from which the teas of commerce are obtained. The favourite garden camellia also belongs to it. The plants belonging to the order are principally inhabitants of Asia and America.



Terns

Terpsichore (tėrp-sik′o-rē). See *Muses*.

Terracina (ter-rȧ-chē′nȧ; ancient Anxur), a seaport of Rome (Latium), Middle Italy. on the Tyrrhenian Sea. It is an episcopal see, and has a trade in grain, fruit, &c. Pop. 7580.

Terra-cotta, or clay baked without glazing, has from an early date been used for a great variety of purposes, notably for tiles and architectural ornament, and for sculpture in relief and in the round. A suitable earth is first prepared by grinding and mixing with water, and the desired article is then modelled direct or more usually moulded (in which case for finer work retouching is necessary), baked, and sometimes glazed, coloured, or gilded. For roofing and decorating buildings, both plain and coloured terra-cotta was much used by the Greeks and Romans. At Pompeii, tiles, gutters, and cornices made therefrom may be seen; and in Rome many slabs decorated in low relief have been found which were used for mural ornament. After the break up of the Empire, terra-cotta fell into disuse in Western Europe, until in the fourteenth and fifteenth centuries it became a frequent adjunct to architecture in Italy and Germany. Fine examples of its use at this period are the church of St. Catherine, Brandenburg, and the Certosa, near Pavia. Later, its use spread to parts of France, to Spain, and to the south and east of England; but in the seventeenth and eighteenth centuries it fell into disrepute, until a widespread revival in the middle of the nineteenth century, which in England produced such buildings as the Albert Hall and the Royal College of Science. A modern instance of the use of glazed terra-cotta is the tube stations of London. As material for the sculptor, terra-cotta was used in Egypt and Crete; and in Greece took the charming form of the small statuettes, of which the best examples have been found at Tanagra, in Bœotia. These figures date from 850 to 200 B.C., and chiefly represent, in singularly graceful and attractive fashion, Greek women in the ordinary costume of the day. In Italy the Etruscans used terra-cotta freely for the decoration of sarcophagi, and terra-cotta statuettes were very popular with the Romans, and have been found in every Roman colony. After a period of unpopularity, in the fifteenth and sixteenth centuries it became the medium in which Donatello, Verrochio, Luca della Robbia, and their lesser contemporaries produced some of their greatest masterpieces; and in the seventeenth and eighteenth centuries it was much used, especially for sketches, or as the basis for subsequent work in bronze or marble. Its advantage over the latter material is the freer, swifter handling it permits. To-day it is again somewhat out of favour, sculptors preferring, as a rule, to take casts in plaster of Paris from a clay model.

Terra di Sienna, a brown ferruginous ochre employed in painting, and obtained from Italy. When calcined before being used as a pigment, it is known as burnt sienna.

Terrano′va, a town of Sicily, in the province of Caltanissetta, on the Mediterranean, near the mouth of the River Terranova. It was founded by Frederick II on the site of the ancient *Gela.*

There is some export trade in corn, wine, fruit, sulphur, and soda. Pop. 22,020.

Ter'rapin, the popular name of several species of freshwater or tide-water tortoises of the family Testudinidæ, distinguished by a horny beak, a shield covered with epidermic plates, and feet partly webbed. They are active in their habits, swimming well and moving with greater agility on land than the land-tortoises. They are natives of tropical and warmer temperate countries, many being natives of North America. They feed on vegetables, fish, reptiles, and other aquatic animals. Their flesh is much esteemed. The name is more particularly applied to *Malacoclemmys terrapin*, native to the salt marshes extending from Rhode Island to the Gulf of Mexico, and especially abundant round Charlestown. Special terrapin farms or ' crawls ' have been established to rear them for the market.

Terre-Haute (târ-ōt; usually pronounced ter-e-hōt'), a city of Indiana, United States, the county seat of Vigo county, on the Wabash, and Wabash and Erie Canal. It is a coal-mining centre, and the nodal point of a busy agricultural region. Pop. (1920), 66,083.

Terrestrial Magnetism. The earth behaves as if it were a common magnet on a gigantic scale, that is to say, it is surrounded by so-called magnetic lines of force. These lines of force represent everywhere the direction into which the magnetic axis of any magnetized needle is urged (see *Magnetism*). There is no force of translation on the needle, but only a *couple*. In the British Isles to-day such a needle, if free to turn in any direction (for instance, if immersed in a fluid of the same density as itself), would point somewhat steeply down at an angle of about 66° with the horizontal, and, seen from above, its north-seeking end would be found pointing about 14° w. of true or geographical north (see *Declination*; *Dipping-needle*). With the statement of these two angles there remains only one thing to complete the description of the magnetic field at a point, namely the *strength* of the field. We could, if we wished, give instead of the strength and two angles, the component strengths parallel to three rectangular axes of co-ordinates. It is usual to give the horizontal intensity and the two angles mentioned above. Of these the vertical angle is called the *inclination* or *dip*, and the horizontal angle is called the *declination*.

Magnetic instruments are of two classes, for absolute and relative measurements respectively. In order to determine the declination, it is only necessary to suspend a magnet in such a way that it is free to turn in a horizontal plane, and to measure the angle between its magnetic axis and the meridian at the place. To eliminate any error due to the fact that the axis of figure may not be the magnetic axis, it is necessary to arrange the suspension so that the magnet may be turned, bottom for top. The inclination or dip is measured with a *dip-circle*, which consists of a magnet mounted on a horizontal axis resting on knife edges. A vertical circle gives the required angle, and sixteen readings are necessary in all. In the course of these the needle has to be remagnetized in the opposite sense. The *horizontal intensity* (H) is measured by causing a magnet to deflect another magnet out of its normal position in the earth's magnetic field, and afterwards allowing the first magnet to oscillate undisturbed in a horizontal plane under the influence of the earth's horizontal component of magnetic force. The time of swing is a measure of the product MH, where M is the magnetic moment of the magnet. The deflection experiment measures the ratio M/H, so that the two results when combined give both M and H.

Instruments are in use for the permanent *recording* of the three *magnetic elements*, as they are called. For H, a magnet is suspended by a bi-filar, and is forced by this means into a position at right angles to the magnetic meridian. Any changes in H then cause the suspension to unwind or wind up a little in proportion with the magnitude of the change. The inclination I is not directly recorded, but V takes its place, V being the vertical component of the earth's field, so that $\tan I = V/H$. A magnet is so balanced on knife edges that the vertical magnetic force tending to make it tilt is balanced by the action of gravity. Small changes in V then produce proportional tilts in the magnet. The positions in all cases are recorded photographically by a spot of light reflected from a small mirror on the magnet. It has been proposed to supersede the deflexion and oscillation experiments by an electrical method involving the field of a coil of wire carrying a current.

If the *magnetic poles* of the earth, i.e. the places where the dip is 90°, lay in the earth's axis, the lines of force would everywhere run in the geographical meridian, i.e. the declination would everywhere be zero. All lines connecting places with similar magnetic states, such as *isoclinal lines* for places of equal inclination, would be parallels of latitude. Actually there are considerable variations from this simple distribution, and the magnetic poles, instead of coinciding with the geographical poles, are situated at about 70° N., 97° W., and 73½° S., 147½° E. Thus the north magnetic pole is on the meridian of Winnipeg, half-way from that place to the geographical North Pole, while the south magnetic pole is on the meridian of Hobart Town, and is two-thirds of the way from there to the geographical South Pole. The antipodal point of either magnetic pole is over 1300 miles from the other magnetic pole.

The magnetic elements at all points are subject to *changes* of several kinds. The *secular change* is a slow change in all the elements extending over centuries (see *Declination*). Besides the secular changes there are rapid fluctuations in the magnetic elements, in which regular waves having a diurnal and a semi-diurnal period have been detected. These have been referred to atmospheric electric currents produced either by the tidal action of the moon and sun on layers of the earth's atmosphere which are not electrically neutral, or (more intensely) by the projection of radiations, both corpuscular and ultra-violet, from the sun into the upper atmosphere. Intense corpuscular streams give rise to so-called magnetic storms, which are disturbances world-wide in their incidence, and whose *sudden commencements* are nearly but not quite simultaneous at places widely separated. A connection has been established between the frequency of sunspots and of magnetic storms. Unfortunately the current rate of annual change in the British Isles cannot be determined from the mean rate over a number of years. Between 1901 and 1915 the annual change of declination increased from about 4 minutes to 10 minutes It is usual as a first approximation to take, for the present day, 9 minutes as the annual diminution of declination in the British Isles. The *dip* attained a maximum of nearly 75° about the year 1700, and was in Jan., 1915, 66° 52′ at Greenwich.—BIBLIOGRAPHY: Stewart and Gee, *Elementary Practical Physics*; W. Watson, *Text-book of Physics*; C. Chree, *Studies in Terrestrial Magnetism*; *Terrestrial Magnetism and Atmospheric Electricity* (*International Quarterly*).

Terrestrial Physics, or Geophysics, a subject closely related to *geology*, and including *geodesy*, *terrestrial gravity*, *meteorology*, *oceanography*, *terrestrial magnetism*, and *seismology*. (For these subjects, see separate articles.) In a narrower sense of the word, geophysics refers mostly to the properties of the solid earth and its behaviour under various forces.

Many speculations have been made as to what the interior of the earth is really like. It is generally accepted that the whole of it was once in a molten and intensely hot state, and that its present state is that of a much-cooled and probably still cooling body. This introduces the problem of the age of the earth. If it be idle to speculate on the length of time over which the earth has existed as a separate body, the duration of the geological or crust-forming period is not beyond a guess. From considerations of heat content and heat conduction, Lord Kelvin was led to the estimate of 20 or 30 million years. Recently, however, the admission of radio-activity as a factor in the argument has led physicists, in particular Lord Rayleigh, to an estimate of a few thousands of millions of years, say 4×10^9 years. It must be remembered that in an estimate of this kind the uncertainty is not expressed as plus or minus so much, but as a multiplier or divisor by so much. In the opinion of the late Professor Joseph Barrell, the estimate of 4×10^9 years was not wrong by more than factors ⅓ or 3 times. This estimate has not passed unchallenged, though it is universally agreed that Lord Kelvin's original figure may well be many times too small.

Returning to the question of the earth's interior, one of the most natural suppositions is that there is a hot fluid interior surrounded by a comparatively thin crust. We have before our eyes the phenomena of volcanoes with their outpourings of lava. Yet the fluid theory is now abandoned by geologists and physicists alike. The extrusions of volcanoes are not on a scale comparable with the action of stresses known to exist in the earth's crust. More conclusive still, the propagation of earthquake waves, both compressional and distortional, to great distances shows that not only is the earth a solid to a depth of more than half its radius, but it is a rigid solid rather than a viscous mass. Next comes the problem: If the bulk of the earth be rigid, how can the movements observed in the crust take place? Plainly, there have been in the past, and there are in progress now, great earth movements, displacing portions of the crust both vertically and horizontally. Part of Scandinavia has been proved to be undergoing actual elevation at the present day at the rate of about 1 centimetre per annum; while in the foreground of the Bavarian Alps relevelling and retriangulation after lapses of thirty or forty years have established vertical movements of 0·1 metre, and horizontal movements approaching 1 metre. These movements are consistent with a continued pushing northwards of the Alpine mountain mass. On the small scale we may observe in exposed cliffs bent and folded strata. How is it possible to reconcile these movements with the rigidity which we know the earth to possess? The answer is that the stresses to which the creeping or viscous movements are the response must be very long sustained. That these stresses are continually present we know from earthquake phenomena. But the bulk of the movements in the earth's crust which have made its past history have been of the slow creeping kind. Only now and then does the strain become unstable in a certain region, and produce the sudden release which we know as an earthquake. The most recent views on *isostasy* (q.v.) contain the idea of a somewhat more yielding stratum beneath the outer crust. This stratum is rigid for such short-period stresses as those due to the passage of an earthquake wave, but yields enough to allow of the upheaval of the crust at the points where the latter is naturally light, or has been lightened by denudation.

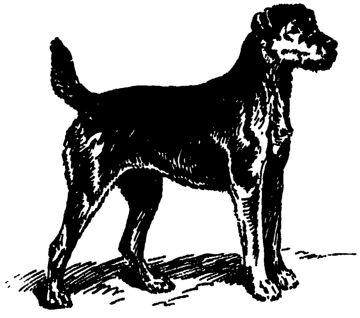
Since the earth is rigid for ordinary stresses, it is necessary to inquire whether a numerical estimate of this rigidity or elasticity can be made. On this problem the rotation of the earth and its changes of position relative to the sun and moon throw interesting light. Although the spheroidal figure of the earth is practically that of a fluid rotating under similar conditions, the phenomenon known as Chandler's Nutation shows that the earth is now, as a whole, as rigid as steel. This nutation, or nodding, consists in a very minute displacement of the earth's axis of rotation amounting to a wandering around a radius of about 15 feet at the pole. The period of the free nutation, which was predicted by Euler to be 10 months, was shown by Newcomb to be modified to 14 months by a supposed finite earth rigidity equal to that of steel. Again, it has been shown that in a viscous earth the free nutation would soon be damped out. What Chandler demonstrated by an elaborate analysis of observations was a periodic variation of latitude with a period of about 480 days, and showing no signs of being damped out. Therefore the earth is as rigid as steel, and for stresses of as long duration as 6 or 7 months shows still no viscous yielding as a whole. This is borne out by experiments on tides in water-pipes by Michelson and Gale in the United States.

Besides the world-wide force exerted on the earth by reason of its own rotation—the centrifugal force—and its change of position relative to the sun and moon—the tidal forces—there are some minor reactions of the two envelopes with which the earth is invested. *First*, the ebb and flow of great masses of water on the shores of the land produces a minute tilt in the solid crust. This is a difficult measurement to make, but it has been successfully accomplished. The difficulty lies not only in the extreme delicacy of the measurement, but in disentangling from it small effects due to other causes than the one considered, viz. the tilting due to response of the earth itself to the tide-generating force, the differential tilt, if any, of the pendulum in response to the same force, and the effect of the direct attraction of the tidal water on the pendulum. *Second*, the atmosphere, although very small in density, exerts a pressure whose changes from time to time, and from place to place, are sufficient to react both on the sea and on the solid earth. It is well known that an increase of barometric pressure is able to depress the sea locally, and force it up in places where the barometer is lower. The sea at any given place is therefore a kind of barometer on a very large scale, but the effect is different for each locality, and may be masked by other more complicated factors. It is understood, of course, that these atmospheric effects are additional to the ordinary oscillations which are known as the tides. Again, since the solid earth possesses a finite rigidity, the varying atmospheric pressure must produce distortions in it. The late Sir George Darwin calculated that on occasion the tilt in the earth's crust produced by barometric gradient might be greater than the deflection of the vertical by the direct tidal force of the moon. That the atmosphere does exert an appreciable effect on the rocks of the earth is strikingly illustrated by the fact that barometric gradient has been recently shown to be at least a secondary cause in the precipitation of earthquakes in seismic regions.

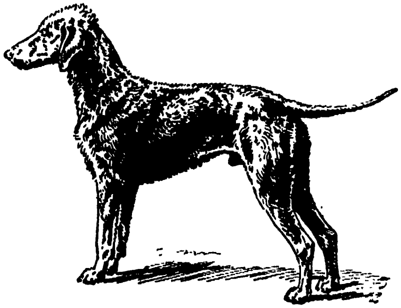
Enough has been said to make it clear that the solid earth, far from being the inert mass which it presents to a first gaze, is the seat of a continual evolution. Though it is true that the changes take place at a rate which seems infinitesimal to any given generation of mankind, it is largely upon this physical evolution of the earth's crust that the destiny of the human race has depended in the past, and may depend in the future. — BIBLIOGRAPHY: O. Fisher, *Physics of the Earth's Crust*; J. W. Gregory, *The Making of the Earth*.

Terriers. This class of dog is noted for its gameness and intelligence. From the smallest (Yorkshire) to the largest (Airedale) they all make excellent watch-dogs. The Airedale, on account of his strength and courage, is largely used by police to accompany them in patrol work. The fox terrier and Border terrier are used in ' bolting ' the fox, i.e. they are put into a drain or den, and by their courage force the fox into the open. They are all good ' ratters '.

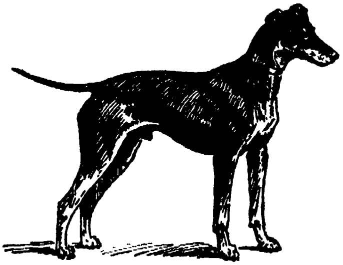
Airedale: rough coated; marks—black saddle and tan. *Kerry Blue*: long hard blue coat; resembles the Airedale in size and weight. *Irish*: rough hard coat, red in colour. *Fox*: two types, smooth and rough; colour white with black, or black-and-tan marks. *Scotch*: coat wiry and hard; colour black or brindle; stands on short straight legs, and long body. *West Highland*: coat wiry and hard; colour white with no marks; in temper resembles Scotch. *Cairn*: small-sized terrier; dark or light brindle in colour; very game. *Sealyham*: resembles wire-haired fox terrier, but on shorter legs, and longer in the body. *Bedlington*: medium-sized, built on racing lines; coat silky, close, and wavy; colour blue, and ears placed on side of



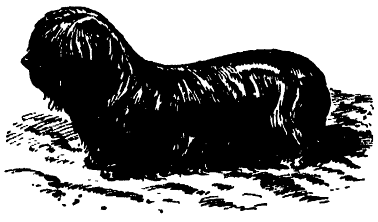
Welsh Terrier



Bedlington Terrier



Black-and-tan Terrier



Skye Terrier

See also Plate 'Dogs' in Vol. IV.

head. *Welsh:* miniature Airedale; colour and markings the same. *Dandie Dinmont:* coat fairly long and wavy; colour either pepper (bluish) or mustard (red). *Skye:* coat long and silky, and blue coloured; stands on short legs; has a longish body. *Yorkshire:* coat long and silky; colour blue with tan markings; ladies' toy terrier, and smallest. *Bull Terrier:* coat short, close, and fine; colour white; originally a cross between bulldog and fox terrier. *Border:* coat smooth and thick; colour sandy; second smallest terrier; very game. *English* (*Black-and-Tan*): name gives his colour; coat short and fine.

Territorials (Territorial Army), the second-line army of the kingdom. Under the name of the Territorial Force it was first formed in 1907 out of the existing yeomanry and volunteers (Territorial and Reserve Forces Act, 1907, 7 Edw. VII, c. 9). The heading of this Act was: "An Act to provide for the reorganization of His Majesty's Military Forces, and for that purpose to authorize the establishment of County Associations and the raising and maintenance of a Territorial Force. . . ." In accordance with this Act, county associations, consisting of a president, chairman, military representative, and co-opted members, were formed in each county (or portion of a county where the area was too extensive to be dealt with as a whole), for the purpose of organizing and administering the Territorial units within the area, of recruiting for the force, of providing training facilities and accommodation for arms and equipment. The Associations also exercised the right of submitting names for first appointments to commissions in the force. Enlistments were for a period not exceeding four years, and the annual training was for not less than eight or more than fifteen days, in addition to certain drills. The area of service for the force was limited to any part of the United Kingdom, and "no part of the Territorial Force shall be carried or ordered to go out of the United Kingdom". A proviso was, however, made to the effect that "it shall be lawful for His Majesty, if he thinks fit, to accept the offer of any part or men of the Territorial Force, signified through their commanding officer, to subject themselves to the liability (1) of serving outside the United Kingdom; (2) of undertaking actual military service for the *defence of and within* the kingdom whether the Force was embodied or not". It was under this section that the services of the greater proportion of Territorial units became available in the early days of the European War, for, though the whole force could be and was embodied along with the rest of the Reserve forces, yet, legally, only home defence could be demanded of them.

During the war the units of the Territorial

Force served with great distinction in more than one theatre of war, and the Earl of Ypres has said that in the first year of the war it would have been impossible to have held the Germans without the assistance of the Territorial divisions. At the outbreak of war the Territorial Force numbered fourteen divisions; by raising new units this number was rapidly doubled. In France, Belgium, and other theatres the exploits of the 47th (London) Division, the 51st (Highland) Division, the 55th (West Lancashire) Division, and the 56th and 58th (London) Divisions, among others, are matters of common knowledge. (For a summary of Territorial exploits during the European War, cf. Rudolf's *Short Histories of the Territorial Regiments of the British Army.*)

In common with the rest of the army the Territorial Force underwent its post-war reorganization, from which it emerged as the Territorial Army, with an obligation to serve in any part of the world where its services might be required in time of imminent national danger. In order to prevent any possible misuse of this power by the Government of the day, a proviso is contained in the Act to the effect that before Territorial units are ordered out of the country the case must be laid before Parliament. In March, 1921, 100,000 of all ranks had been enlisted into the Territorial Army, the desired establishment being 236,000; by July, 1922, the number had risen to nearly 138,000 of all ranks. The original establishment, however, was subsequently reduced to just over 175,000.

The Territorial Army, like the original force, consists of all arms, but whereas in the Force there were fifty-five regiments of yeomanry-cavalry (q.v.), in the Territorial Army of to-day there are only ten regiments of cavalry, the remaining forty-five being in process of conversion into armoured-car or artillery units. This is in keeping with the trend of modern ideas, and conforms to some extent with the action taken as regards the regular cavalry. The Honourable Artillery Company ranks as the senior corps in the Territorial Army. This unit has an unbroken existence since the fifteenth century, and became part of the Territorial Force in 1908.

The Territorial Army is represented at the War Office by a Director-General, who is a member of the department of theUnder-Secretary of State for War. No unit of the Territorial Army (unless embodied) can be called out in aid of the civil power. Embodiment means calling out on permanent service, and is done by means of a Proclamation. The Territorial Army cannot be embodied unless and until the whole of the Army Reserve has been called up. See *Army*; *Volunteers.*

Territory (Lat. *territorium*), a designation with many meanings, the chief of which have political significance. In the Holy Roman Empire, the Empire possessed no territorial domains, and the word 'territory' indicated the lands of reigning princes, Imperial cities, and free towns, and the sphere within which these sovereigns and states exercised seigniorial or sovereign rights. In modern times in the United States a territory is a region under Union Government but not yet admitted as a state. Canada has two territories, Yukon Territory and the North-West Territories (q.v.). Australian territories are of three kinds: (1) those forming part of the Commonwealth and not belonging to individual states (Federal Capital Territory and Northern Territory); (2) those accepted under Clause 122 of the Constitution, which provides for further territorial acquisitions (Papua and Norfolk Island); and (3) those accepted under mandate from the League of Nations (New Guinea and Nauru Island). Some South American republics have territories that are not yet states, e.g. Brazil (Territory of Acre), Bolivia (Colonial Territory), and Chile (Magallanes Territory). Argentina has ten territories: Misiones, Formosa, Chaco, La Pampa, Nequén, Rio Negro, Chubut, Santa Cruz, Tierra del Fuego, and Los Andes.

Terry, Ellen Alice, English actress, born in 1848. She made her first appearance on the stage in 1856 at the Princess's Theatre, under the management of Charles Kean. On 30th Dec., 1878, she made her first appearance with Henry Irving at the Lyceum Theatre. Her rôle on that occasion was Ophelia, always one of her finest parts; and among others sustained by her during her long association with the Lyceum and Sir Henry Irving are Pauline (*The Lady of Lyons*), Portia, Juliet, Beatrice, Viola, Lady Macbeth, title-rôle in Reade's *Nance Oldfield*, Queen Katharine in *Henry VIII*, Cordelia, Rosamund (Tennyson's *Becket*), Guinevere (Carr's *King Arthur*), and Imogen.

Terschelling, an island of the Netherlands, in the province of North Holland, at the entrance to the Zuider Zee; area, 42 sq. miles (partly inundated). Hoorn is the chief town, and Westerschelling is the fishery centre. Pop. 4120.

Tertullian (Quintus Septimius Florens Tertullianus), the earliest of the great Latin Fathers, born between A.D. 150 and 160 at Carthage, son of a Roman centurion, died between 220 and 240. He was converted, probably in Carthage, about 192, and was made a presbyter. In middle age, about 202, he became a Montanist (see *Montanus*). He is known chiefly through his writings, which are very numerous, whether in the Catholic or the Montanist period of his career. His most celebrated work is the *Apolo-*

geticum, a formal defence of Christianity, addressed to the governor of proconsular Africa, and couched in defiant rather than persuasive terms. He wrote other apologetic works, also works of a doctrinal and practical nature. The *Ad Praxeam* is a landmark in Western theology, and is of special significance for the history of the development of Trinitarian doctrine. He was the founder of ecclesiastical Latin, and his works display great learning, much imagination, and a keen if often coarse and satirical wit. He was the first of the great triumvirate of the African Church, the two others being Cyprian and Augustine.

Teruel′, an inland province of North-Eastern Spain. It is largely mountainous. Teruel is the capital. Area, 5720 sq. miles; pop. 256,000.

Teruel, a city of Spain, capital of the province of Teruel, near the Guadalaviar; served by the Calatayud-Valencia Railway. An ancient city, Teruel is a bishop's see, and has a cathedral. Pop. 11,935.

Terza Rima, an Italian form of versification, consisting of three iambic lines of eleven syllables each. Each stanza is linked with the next, lines 1 and 3 repeating the central rhyme of the preceding stanza. The rhyme scheme is therefore as follows: aba, bcb, cdc, &c. The terza rima was perfected by Dante, who used it in his *Divina Commedia.* The verse form was introduced into English by Sir Thomas Wyatt, and experimented with by Sir Philip Sidney and Milton. Mrs. Browning's *Casa Guidi Windows* is written in terza rima.

Teschen (Pol. *Cieszyn*; Czech, *Těšin*), a former district of Austrian Silesia, known as Lower or Eastern Silesia. Troppau was the Upper or Western district, and these two, comprising an area of 2026 sq. miles, formed the smallest Crown-lands of the Austrian Empire, the fragments of the Old Silesia surrendered by Maria Theresa to Frederick the Great of Prussia (1742). After the European War, in 1919, a territorial dispute began between Poles and Czechs regarding the ownership of Teschen, a desirable area producing coking-coal, and at the same time a veritable hive of industry. In the area Poles made up 76 per cent of the population; Germans, 17 per cent; and Czecho-Slovaks, 6 per cent. On 8th July, 1920, the Council of Ambassadors at Paris partitioned the region, the east (predominantly Polish) being attached to Poland, while the Czechs received the mining region and the chief railway. Teschen, the capital, is a busy banking and industrial town, with a trade in leather, wool, iron, and wines. Pop. 22,470.

Tes′seræ, small cubes or squares resembling dice, and consisting of different materials, as marble, precious stones, ivory, glass, wood, &c. These *tesseræ* were used by the ancients to form the mosaic floors or pavements in houses, for ornamenting walls, &c. See *Mosaic.*

Testing of Materials. In engineering workshop practice, the properties of materials, knowledge of which is essential for both manufacturer and designer, is obtained by conducting a series of tests upon samples. *Tests of forgings.* If forgings are not too large and are of suitable section, tests are taken from the actual forgings in a ratio of 1 in 10 pieces. When the forging is large and too expensive to destroy, permission is usually given to make it of sufficient size to include a test-piece, which must represent an average section of the forging. The test-piece must not be further reduced by hammering, nor reheated, but may be machined to test-piece dimensions. The usual tests taken from forgings are tensile, bend, and hardness (Brinell) tests. The form of the tensile test-piece is preferably circular, but where the section of material does not admit of this it is rectangular. The ends of the test-piece are screwed to fit the screwed socket of the testing-machine, or when rectangular left plain to suit the serrated wedges of the machine. The centre part of the test-piece is turned down to a standard size corresponding to the capacity of the machine, and to ensure fracture within the actual test-piece distance, which may be 2, 6, or 8 inches, care should be taken to have a direct axial pull on the test-piece. *Bend tests* are usually supplementary to and taken from the same test-pieces as the tensile tests. These pieces are of $1\frac{1}{4}$-inch square section, about 8 inches long, and are bent cold round a diameter $2\frac{1}{2}$ times the thickness of the test-piece until the ends meet, then hammered until the arms are parallel without sign of fracture. *Brinell hardness tests* consist in pressing a hardened steel ball, of radius 5 mm., into the flat surface of the test-piece under a pressure of 3000 Kgm. and measuring the curved area of the indentation. Brinell

$$\text{hardness number} = \frac{\text{total pressure}}{\text{curved area of indentation}},$$

the pressure being in Kgm., and area in sq. mm. *Rivet tests.* The following are three representative tests as required by the Admiralty: (1) bending double when cold without fracture round a radius equal to half the diameter of the rivet; (2) bending double when hot, and hammered till the two parts of the body are parallel and touching without fracture; (3) flattening of the rivet head while hot until its diameter is $2\frac{1}{2}$ times the diameter of the body without fracture. *Tests from castings.* The test-pieces should be cast with, and joined to, the casting they represent. Both tensile and transverse tests are taken. The tensile test is made on a 2-inch length, 6 inches overall.

For the transverse test the sections are: 2 in. × 1 in. × 3 ft. long on 3-ft. centres, and the bar to break with a minimum load of 28 cwt.; also 2 in. × 1 in. × 14 in. and 1 in. × 1 in. × 14 in. long, each on 12-in. centres. The foregoing are typical tests in general specifications; other and more elaborate tests are usually confined to research and laboratory work. See *Strength of Materials*.

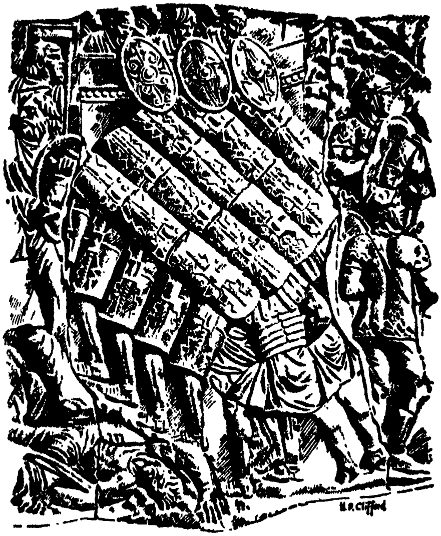
Testing of Milk. Various methods are adopted, other than those of the analytical chemist, for ascertaining the purity, fat content, &c., of milk. For specific gravity, rapid tests are made by lactometer (q.v.) or Westphal balance (q.v.). The percentage of fat present in a given sample is found in Great Britain by the Gerber system mainly, what is known as the Babcock system being favoured in the United States and the Imperial colonies. In testing milk by the Gerber system, 11 c. c. of the sample are pipetted into a special test-tube, 10 c. c. of sulphuric acid (specific gravity, 1·820 to 1·825) being added, and 1 c. c. of amyl alcohol run in finally to prevent charring. The test-tube is corked, shaken up, and revolved in a centrifugal apparatus for about five minutes, when the fat separates out, and may be read off directly as a percentage from the scale on the neck of the test-tube. A method devised by Dr. Gerber, and called the 'Sal' system, makes use of a special 'sal' solution and butyl alcohol, instead of sulphuric acid and amyl alcohol.

Test-papers, slips of unsized paper impregnated with solutions of vegetable colouring-matters or other chemical reagents, used as indicators of the presence of acids or of alkalis or of special chemical compounds. The most common test-papers are litmus, turmeric, and starch papers.

Testudo, among the ancient Romans a cover or screen which a body of troops formed with their oblong shields or targets, by holding them over their heads when standing close to each other. This cover somewhat resembles the back of a tortoise, hence the name (Lat. *testudo*, tortoise), and served to shelter the men from missiles thrown from above. The name was also given to a movable structure on wheels or rollers for protecting sappers.

Tet'anus, a disease of the central nervous system, caused by the bacillus tetani. The bacillus gains entry to the body through a cut or wound, and from the original site of infection the toxins are carried by the circulation to the nervous system. The incubation period varies considerably, but ten days is the most frequent period. The premonitory symptoms are sleeplessness, restlessness, sweating, with muscular twitchings, followed by definite muscular spasm, which is usually first seen in the masseter muscles of the face, so that the patient is unable to open his mouth; hence the popular name, lockjaw. The neck next becomes rigid, and then the muscles of the trunk and limbs. The spasms cause great pain, and it is necessary to control them by morphia, chloral, or chloroform. During the European War (1914–8) at first many of the wounded were infected with tetanus, until prophylactic inoculation with antitetanic serum was introduced. This was found to be of great value, and when it had been established and every wounded man was inoculated as early as possible, the number of cases of tetanus became very small.

Tete, a district and town in the province of Mozambique, Portuguese East Africa. *Physical.*—The district is sandwiched between Nyasaland and Rhodesia, and through it the Zambezi River passes in a wide sweep from west to east, forming a northern and a southern region. The former rises gradually to the plateau of Central Africa, and is in parts densely wooded, towards the Nyasaland frontier. In the south the land rises to the plateau of Southern Rhodesia. The whole region is more or less dominated by the tsetse fly, and transport presents a problem, for the only railway is the section of the Central African system, running from Chindio to Port Herald in Nyasaland, a distance of 60·5 miles. The river is navigable for stern-wheel river-steamers as far as Tete town, but it is broken by the Kebrabasa rapids



Roman Soldiers fighting under a Testudo
(from a bas-relief)

(60 miles) farther up. The Shiré River bounds the northern region in the east, and the Ruenya does the same for the southern. Zumbo may be considered the western river-outpost of the district. *People.*—The natives number, perhaps, 200,000, and the Europeans only 200. There are some Asiatic traders. *Resources.*—The mineral wealth of Tete is undeveloped, but millions of tons of excellent coal await exploitation. A large area is the monopoly of the Campanhia de Zambezia and the Zambezia Mining Development Company. Iron, magnetite, and limestone are found, and there is some alluvial gold-mining near Tete town. *Tete Town* is a Zambezi port and the district capital, and is the terminal of a projected line from the Chindio-Port Herald Railway. It stands in a dry, treeless region, is the head-quarters of Europeans and Asiatics, and is a collecting-centre for gold-dust and ivory. See *Portuguese East Africa* (section 1 and economic sections).

Tetrabranchia'ta, an order of Cephalopoda or cuttle-fishes, having four branchiæ or gills, comprising the two families Nautilidæ and Ammonitidæ. Of this order the pearly nautilus may be regarded as the type, being the only living member of the order, though its fossil representatives (Orthoceras, Ammonites, &c.) are abundant. See *Nautilus.*

Tetrahe'drite, or **Grey Copper Ore**, a mineral sulphide of copper and antimony, occurring in many mines, and containing about 40 per cent of copper. Silver is usually present in it.

Tetrazzini, Luisa, Italian prima-donna (soprano), born 1874. A Florentine herself, she made her début in the Teatro Verdi there (1895), and eventually appeared at Covent Garden (1907), after enjoying musical triumphs in Rome and New York. *Lucia di Lammermoor* is her favourite opera. In 1921 she published *My Life of Song.*

Tetuan', the administrative capital of the Spanish Zone of Morocco; connected with its outposts and with Ceuta by railway. Pop. about 30,000.

Tetzel, Johann, German friar, born about 1470, died in 1519. He entered the order of the Dominicans, and in 1502 was appointed by the Roman see a preacher of indulgences, and carried on for fifteen years a very lucrative trade in them. His life was so corrupt that at Innsbruck he was sentenced to be drowned for adultery, but got off through powerful intercession. Having travelled to Rome, he was absolved by Pope Leo X, and now carried on the sale of indulgences with still greater effrontery. Luther came out with his theses against this crying abuse in 1517. Tetzel died of the plague in the Dominican convent at Leipzig. A great part of the money acquired by his traffic in indulgences was used for the erection of St. Peter's church at Rome.

Teu'tones, or **Teutoni**, a tribe whose original home seems to have been a district in the north-west of Germany to the north of the Elbe. In 102 B.C., together with the Ambrones, they invaded Gaul and reinforced the Cimbri. They ravaged Gaul, but were defeated in a great battle near Aquæ Sextiæ (or Aix) by Marius. It has been questioned by some writers whether the Teutones were a German rather than a Celtic or Slavonian race, although they are classified by Strabo as Germani.

Teutonic Languages. See *Philology.*

Teutonic Order, a military religious order of knights, established (1198) in imitation of the Templars and Hospitallers. It was composed chiefly of Teutons or Germans who marched to the Holy Land in the Crusades, and originally established (1190) as a Jerusalem charitable institution. In the thirteenth century the order acquired Poland and Prussia, and long held sway over a great extent of territory in this part of Europe. It began to decline after the defeat of the knights at Tannenberg, by King Ladislaus II (or Yagello) of Poland (1410), and was finally abolished by Napoleon in 1809.

Tewfik Pasha, Mahommed, Khedive of Egypt, eldest son of Khedive Ismail, was born in 1852, died in 1892. He succeeded to the Viceroyalty (8th Aug., 1879) upon the forced abdication of his father. He was the sixth ruler of Egypt in the dynasty of Mahommed Ali Pasha.

Tewkesbury (tūks'be-ri), a municipal borough of Gloucestershire, England, where the Avon joins the Severn. Pop. (1921), 4704.

Texas, a west-south-central state of the United States, and the largest of that country. Area, 262,398 sq. miles; pop. 4,668,280 (fifth in population, coming after New York, Pennsylvania, Illinois, and Ohio). Texas has a coast-line of about 400 miles on the Gulf of Mexico. It is fringed by storm-beaches and lagoons, which give place to a wide alluvial coastal plain, backed by a central prairie-land, merging in the west with the high plateau and the eastern region of the Llano Estacado (see *Llanos*). A northerly projection of the state between Oklahoma (east) and New Mexico (west) is called the Panhandle, and is drained in the north by the Canadian River. The Red River forms the northern boundary of the state, east of the Panhandle, and the Rio Grande del Norte forms the southern boundary.[1]

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[1] The Rio Grande del Norte rises in Colorado (San Juan Mountains), flows southwards through New Mexico, and bends south-eastwards to form the Texas-Mexican (Chihuahua-Coahuila) frontier for a distance of 1350 miles, falling into the Gulf of Mexico after a course of over 2000 miles.

Forming part of the eastern boundary with Louisiana is the Sabine River, which rises in Texas; and the Colorado, entirely within the state, drains the central prairie region. Other rivers are the Brazos (east-central) and the Pecos (west). Climatically, Texas is healthy; but the Panhandle is cold in winter. The mean annual temperature at Galveston (69 feet altitude) is 69·8° F. (July, 83·6° F.; January, 53·6° F.), and at San Antonio (701 feet altitude) 68·9° F. (August, 88·3° F.; January, 52·7° F.). September at both places is the wettest month. Austin (pop. 34,880) is the state capital, but San Antonio (161,380) is the largest city. Galveston* (42,250) is the chief United States cotton port; other cities are: Dallas (159,000), Houston (138,000), Fort Worth (106,500), El Paso * (77,500), Beaumont (40,400), Wichita Falls (40,000), Eagle Pass *, Brownsville *, and Corpus Christi *. Over 16,100 miles of railway traverse the state (e.g. Santa Fé, Southern Pacific, and Colorado & Southern Railways), and there is an electric traction mileage of over 1000. Texas is a prosperous agricultural state, producing maize, wheat, rice, tobacco, sorghum, and fruit, and is one of the great cotton producers, with an output of some 2,000,000 bales per annum. The live-stock industry is progressive, and supports an extensive allied manufacturing industry in slaughtering and meat-packing; while the annual wool-clip amounts to about 17,000,000 lb. Minerals worked include petroleum and natural gas, bituminous coal, mercury, and many varieties of stone. The refining of petroleum is the most valuable industry, with meat-packing second; but there are large rice-cleaning and polishing interests, and cottonseed-oil and -cake manufactures. Of a total population of 4,663,230, about 249,600 are Mexicans, 57,500 German-Austrian, and 7700 British; 741,694 negroes, 1260 Asiatics, and 2110 Indians comprised the non-European element in 1923. The colour-line is rigid, even in education, and the blacks have their own State university. There are four denominational universities (Roman Catholic, Methodist (2), and Baptist), and one State university at Austin (founded 1883).

Texas originally formed a part of Mexico, but declared its independence in 1835–6, and in 1846 was admitted into the Union as a state. There are 253 counties. The legislature is bicameral, comprising a Senate (31 members, one-half elected biennially for four years) and a House of Representatives (up to 150 members, elected biennially). 2 Senators and 18 Representatives are sent to Congress.—BIBLIOGRAPHY: G. P. Garrison, *Texas* (an historical treatise); C. W. Raines, *Bibliography of Texas*; F. W. Simonds, *Geography of Texas*.

Texel, an island of the Netherlands, in the province of North Holland, at the entrance of the Zuider Zee, and separated from the mainland by the narrow channel of Marsdiep. The island furnishes excellent pasture for sheep, and it is noted for cheese made from sheep's milk. The capital is Burg. Area, 71 sq. miles; pop. 6407.

Tezcu'co, or Texcoco, a town of Mexico, in Mexico state, on the eastern shore of the Lake of Tezcuco (salt); served by rail to Mexico City. Under the name of Akolhuacan, Tezcuco was a chief seat of Aztek culture. Pop. 5930.

Thackeray, William Makepeace, English novelist, was born at Calcutta, 18th July, 1811, and died on Christmas Eve, 1863. His father came of an old Yorkshire family, and was an Indian civil servant. He died when Thackeray was only five years old, and Thackeray's mother married Major Henry Carmichael Smyth, who was to some extent the model for Colonel Newcome. In 1817 Thackeray was sent to England for his education; on his way home the ship touched at St. Helena, and he saw Napoleon at Longwood. After attending several private schools, he was sent to Charterhouse, where he remained for six years. He was too sensitive to be happy at school, and spoke of it as 'Slaughterhouse', though time softened the memories of his boyhood. In 1829 Thackeray went up to Trinity College, Cambridge, in a by-term. He did not distinguish himself, and went down without taking a degree; but he made many friends, among them being Monckton Milnes, Spedding, Fitz Gerald, and W. H. Thompson. He also wrote a burlesque poem on *Timbuctoo*, the subject set for the chancellor's English medal which Tennyson won. He had an independent income of about £500 a year, and was for a time able to follow his inclinations of travelling and studying art. He travelled in France and Germany; visited Weimar, where he saw Goethe, and settled at Paris for a time. He entered the Middle Temple in 1831, but, although he was called to the Bar in 1848 in order to qualify for a post which he did not obtain, he never studied law seriously. He gradually became aware that art was not his vocation, and, having lost almost all his money in some unfortunate speculations and in the failure of an Indian bank, adopted literature as a profession. He was at one time the Paris correspondent of *The Constitutional*, and later (1837–8) he was connected with *The Times*. In 1836 he married Isabella Shawe; his brief married life was an ideally happy one, but it came to an end in 1840, when his wife's mind failed after the birth of a daughter. Thackeray was left virtually a widower with two young

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The asterisk (*) indicates a port of entry.

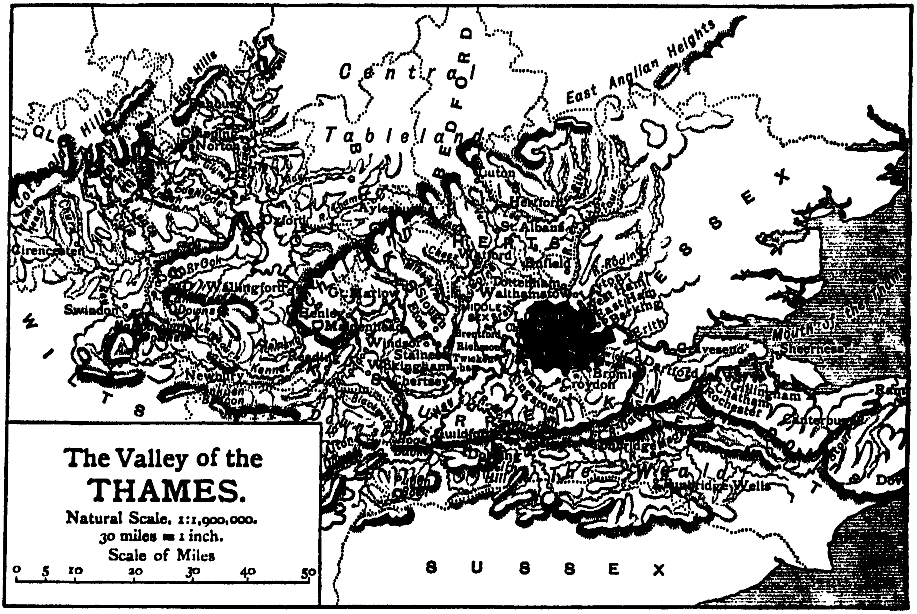
daughters. Mrs. Thackeray did not die until 1894. Thackeray now undertook literary work of all kinds. Under the names of George Fitz-Boodle, Esq., or of Michael Angelo Titmarsh, he contributed to *Frazer's Magazine* tales, criticisms, and verses, which were marked by keen irony and great knowledge of the world. In this magazine *The Great Hoggarty Diamond* appeared; and also *Barry Lyndon*, an unsuccessful imitation of Fielding's *Jonathan Wild.* In 1840 he published *The Paris Sketch-book*, and in 1843 *The Irish Sketch-book.* In 1841 *Punch* first appeared, and Thackeray wrote much for it, to the great benefit of both the periodical and himself. *Jeames's Diary* and *The Snob Papers* both came out in *Punch*; the latter reappeared in book form as *The Book of Snobs*, and is an example of the author at his best. Thackeray did not, however, reach the front rank of living novelists until 1847, when *Vanity Fair* was published in monthly parts, with illustrations by the author. This ' novel without a hero ' is one of the greatest of British novels, in spite of the insipidity of its heroine, and the clumsiness of its nearest approach to a hero. Thackeray's next long story was *The History of Pendennis* (1850), a novel which is partly autobiographical, and less well-constructed than its predecessor. In 1851 he delivered a course of lectures in London on the English humorists of the eighteenth century; this course was repeated in Scotland and America before large audiences, and published in 1853. These lectures, which were undertaken mainly with the laudable object of providing for his family, are vivacious rather than soundly critical. His next novel was *The History of Henry Esmond* (1852), which is considered by many critics to be his masterpiece. It is certainly a wonderful historical novel, unequalled in style and in the vividness of its portraits. Its sequel, *The Virginians* (1859), is, like the majority of sequels, disappointing. *The Newcomes* (1855) is a somewhat desultory novel of family life, redeemed by the figure of Colonel Newcome and the brilliance of some of its scenes. His remaining novels are: *Lovel the Widower* (1860), *The Adventures of Philip* (1862), and the fragmentary *Denis Duval*, left unfinished at his death. In 1855–6 he gave a series of lectures in the United States; he repeated them in England and Scotland, and published them as *The Four Georges.* These lectures are entertaining at the expense of accuracy. In 1857 Thackeray was Radical candidate for Oxford city, and was defeated by a small majority. In 1859 he became editor of *The Cornhill Magazine*, but did not hold the post long, as he was too tender-hearted in his dealings with would-be contributors. His last three novels, together with a series of gossiping articles called *Roundabout Papers*, came out in this magazine. His other works are too numerous to mention, but include *Mrs. Perkins's Ball*, *Rebecca and Rowena*, and *The Rose and the Ring.* His verses are always graceful and finished, and sometimes rise into poetry.

Thackeray stands among the greatest of British novelists. It is a commonplace of criticism to compare or contrast his work with that of Dickens. The names of the two great novelists are joined together almost as inseparably as those of Castor and Pollux, though in truth they have nothing in common save that they were contemporaries and great writers. To some extent Dickens followed the Smollettian tradition, while Thackeray took the more ambitious course of following Fielding. In neither case did the more recent author surpass his model. But although Thackeray is not the peer of ' the prose Homer of human nature ', he has depicted the society of his time in the most masterly fashion, and has, in addition, made the age of Queen Anne live once more by the magic of his pen.—BIBLIOGRAPHY: Lewis Melville, *William Makepeace Thackeray: a Biography*; Anthony Trollope, *Thackeray* (English Men of Letters Series); H. C. Merivale and Sir F. T. Marzials, *W. M. Thackeray*; C. Whibley, *William Makepeace Thackeray*; M. H. Spielmann, *The History of Punch.*

Thalamifloræ, that sub-division of polypetalous dicotyledons in which the flowers are hypogynous.

Thales (thā'lēz), the earliest philosopher of Greece, and the founder of the Ionian school, born about 640 B.C., died about 548 B.C. He was a native of Miletus, in Ionia, and is supposed to have been of Phœnician descent. He is said to have made several visits to Egypt, where he received instructions from the priests, from whom he probably acquired a knowledge of geometry. After his return his reputation for learning and wisdom became so great that he was reckoned among the seven wise men, and his sayings were held in the highest esteem by the ancients. His philosophical doctrines were taught orally, and preserved only by oral tradition, until some of the later Greek philosophers, particularly Aristotle, committed them to writing. He considered water, or rather fluidity, the elemental principle of all things, and maintained that every natural object had its fluid principle which contributed to its preservation.

Thallium, a metallic element (symbol, Tl; atomic weight, 204) discovered by Crookes, in 1861, in a deposit from a sulphuric acid manufactory in the Hartz. In its physical properties thallium resembles lead, but is slightly heavier, somewhat softer, and may be scratched by the finger-nail. It melts at 301° C., and is soluble in the ordinary mineral acids. In colour it resembles silver, but is less brilliantly white. Its specific gravity is 11·9. The tenacity of the metal is less than that of lead; it is possessed of very considerable malleability. Thallium and its salts impart an intense green colour to a non-luminous flame; when a flame so coloured is examined by the spectroscope, one very brilliant green band is noticed, somewhat more refrangible than the sodium line D (see *Spectrum*). The salts of thallium are exceedingly poisonous. It forms two oxides, Tl_2O and Tl_2O_3, giving rise respectively to *thallous* and *thallic* salts. Small quantities of thallium are widely distributed in nature, the metal frequently occurring in iron and copper pyrites, in native sulphur, &c.



The Valley of the
THAMES.
Natural Scale. 1:1,900,000.
30 miles = 1 inch.
Scale of Miles
0 5 10 20 30 40 50

Thallophytes, or **Thallophyta**, the lowest sub-division of the vegetable kingdom, including the Algæ and Fungi, and certain minor groups, such as the Bacteria and Cyanophyceæ. The plant-body may be unicellular, cœnocytic, filamentous, or solid, but always remains a thallus (q.v.).

Thallus, in botany, the term applied to a plant-body which shows no clear distinction of stem and leaves. It may take the form of a branched or unbranched filament, a cœnocyte (q.v.), a flat plate, or a solid mass of cells. It is found in all the Lower Plants or Thallophytes, and in some liverworts; the gametophytes of Pteridophyta are likewise thalloid.

Thames (temz), the chief and longest river of Great Britain. It is properly formed by the Isis, Churn, Colne, and Leach, which have their sources on the east side of the Cotswold Hills and unite near Lechlade. From Lechlade, where it becomes navigable for barges, it flows past Oxford and Abingdon to Reading, Great Marlow, and Windsor to Staines. From Staines it passes Chertsey, Kingston, Richmond, and Brentford, separating the counties of Middlesex and Surrey, and passing through London. Below London its course eastward to the Nore, between Kent and Essex, is 47 miles. Its total course is estimated at 250 miles. Its tributaries include the Windrush, Cherwell, Thame, Colne, Brent, Lea, and Roding, on the left; the Kennet, Loddon, Wey, and Mole, on the right. At London Bridge the width of the river is 280 yards; at Woolwich, 490 yards; at Gravesend, 800 yards; and 8 miles below, 1290 yards. The basin of the Thames has an area of 5400 sq. miles. The tide ascends to Teddington. By means of canals access is given from its basin to those of all the great rivers of England.

Thana, a maritime district and town of the northern division of Bombay Presidency, India. The district borders the Arabian Sea, and produces rice as a staple. The town is the district head-quarters, and is on the Great Indian Peninsula Railway. Area, 3758 sq. miles; pop. (district), 880,000; (town), 16,000.

Thane (A.-S. *thegn*, O.H.G. *degen*, soldier, servant), a title of honour among the Anglo-Saxons. In England a freeman not noble was raised to the rank of a thane by acquiring a certain portion of land—five hides for a lesser thane—by making three sea-voyages, or by receiving holy orders. Every thane had the right of voting in the witenagemot, not only of the shire, but also of the kingdom, when important questions were to be discussed. With the growth of the kingly power the importance of the king's thanes (those in the personal service of the sovereign) rose above that of the highest gentry, ealdormen and bishops forming an inferior class. On the cessation of his actual personal service about the king the thane received a grant of land. After the Norman Conquest, thanes and barons were classed together. In the reign of Henry II the title fell into disuse. In Scotland the thanes were a class of vassals of the Crown, and the title was in use till the end of the fifteenth century.

Than'et, Isle of, a district of Kent, England, at the mouth of the Thames, separated from the mainland by the Stour, and generally referred to as an 'island'; area, 42 sq. miles. It is noted for its bracing air. The chief towns are Margate, Ramsgate, and Broadstairs, all frequented for sea-bathing.

Thann (tàn), a town of France, in the department of Haut-Rhin (Alsace), on the Thur. It is an industrial town noted for wine. Pop. 7500.

Thapsacus, an important city of ancient Syria, on the right bank of the Euphrates between modern Meskene and the confluence of the Belikh, identified with the *Tiphsah* (from a Semitic word meaning 'crossing') of *1 Kings*, iv, 24, which was the northern frontier town of Solomon's kingdom on that side of the Euphrates. *Thapsacus* was the lowest ford of the river, and was used by Cyrus (the younger), and by Darius, who crossed it to meet Alexander at Issus, but was defeated and fled across the ford, pursued by Alexander. Alexander, however, crossed by two bridges, which are assumed to have been bridges of boats. *Tiphsah* of *2 Kings*, xv, 16, was in Palestine, and its location is unknown.

Thar and Parkar, a district of India, in Eastern Sind, bordering the Rann of Cutch. Rice, cotton, tobacco, hemp, wheat, barley, melons, &c., are raised. Muslims (58 per cent) and Hindus (41 per cent) predominate. There are three municipalities, Umarkot (the chief town), Mithi, and Mirpur Khas. Area, 13.941 sq. miles; pop. 400,000.

Tharrawadi, a district and town in the Pegu division of Lower Burma. The district meets the Irawadi on the west, and is mainly a flat alluvial plain producing rice, peas, tobacco, sesamum, sugar-cane, vegetables, maize, and orchard produce. The town is the district headquarters, and is on the Rangoon-Prome Railway. It is more or less a suburb of Thonze. Area, 2851 sq. miles; pop. (district), 400,000; (town), 6000.

Thasos, the most northerly island in the Ægean Sea, a few miles south of the Macedonian coast; area, 150 sq. miles. It is afforested, and produces timber, oil, and honey. Pop. 12,000.

The'atines, an order of monks founded at Rome in 1524 by Gianpietro Caraffa (Pope Paul IV), Archbishop of Chieti, in Naples (ancient *Theate*). They bound themselves to preach against heretics, attend the sick and criminals, and not to possess property or ask for alms.

Theatre (Gr. *theatron*, a place for seeing) now denotes, apart from certain particular uses, usually metaphorical, a place where plays are acted and witnessed.

The origin of the Greek drama being the choric dances in honour of Dionysus, the Greek theatre was shaped by the developments in that religious festival. The earliest feature was the circular, flat 'orchestra', or dancing place, with the altar of the god in the centre. This remained the determining factor in the form of the Greek theatre, though it was modified as time went on through the increased importance of the play and the actors (see *Stage*). As the spectators could see best when ranged above the 'orchestra', it was placed at the foot of a slope. On the slope above it, in the earliest times, the spectators stood or lay; then wooden benches were provided for them, and later tiers were hollowed out of the hill-side and fitted with seats of stone or marble, the lowest tiers being reserved for priests and officials. The tiers were curved, and, owing to the slope of the ground, came to an end on either side of the 'orchestra', making, roughly, two-thirds of a circle, so that the spectators could watch the play from three sides, not four. The performances were given in the open air. Among the chief remains of Greek theatres are that at the foot of the Acropolis at Athens and that at Epidaurus.

The Romans, who derived most of their culture from Greece, adopted the Greek form of the theatre, but altered it to suit a drama that had no direct descent from a sacred dance. The 'orchestra' not being needed for dancing, a segment of it, sometimes amounting to one-half, was cut off by the proscenium or stage-front, and the other portion was used for seating senators and other important people. The semicircular form of the theatre as a whole, with the curved tiers of seats, was in most cases retained; and the theatre had no roof, though an awning was frequently stretched over the auditorium; but whereas the Greeks had hollowed their theatres out of the hill-side, the Romans took to constructing theirs, occasionally, on a flat surface. Interesting remains of Roman theatres may be seen in Provence, as at Orange, Arles, and Vaison. The Roman theatre, where plays were acted, was distinct from the amphitheatre (*amphi-theatron*, the place where you may see from all sides), the great circular or oval buildings surrounding the arena used for gladiatorial fights, animal contests, and other spectacles, as at the Colosseum in Rome, and the arenas at Nîmes, Arles, and other places in Southern France.

The Italian and the French theatres were in the main developments from the classical theatre of Greece and Rome. The direct descent of the English theatre must be traced to other origins. The earliest English theatres were the church, where at certain festivals the clergy would act brief liturgical plays, and the great hall in the house of a nobleman, where wandering minstrels and troupes entertained the company. The liturgical plays proved so popular that, still in the Middle Ages, the church became too small for them. The plays grew in scope, and were performed either on a temporary platform erected in the churchyard or in the central space of the town, or else on movable stages or ' pageants ', on each of which was acted a portion of the complete ' cycle ' of religious dramas making up a ' miracle ', the pageants being wheeled from point to point of the town in succession, so that each set of spectators might see the whole cycle (see *Stage*). The Reformation militated against the religious drama; meanwhile the secular drama had slowly been growing in favour. Plays were acted with increasing success in the halls of great houses, palaces, colleges, and Inns of Court, also in the yards of inns, which were open spaces where the spectators could stand about a platform erected in the middle, and where the galleries that ran round the walls afforded space for those who did not care to mingle with the crowd. To these influences must be added yet another—the circular spaces, or ' rings ', for bull-baiting and bear-baiting, some of which (as may still be seen in certain old English towns) were spaces left for the purpose amid the houses, while others (those, for instance, on the Bankside, the south bank of the Thames at Southwark) were specially built amphitheatres. The growth of the English theatre involved all these elements; but the fact that the first English playhouse was, properly speaking, an amphitheatre, must be ascribed chiefly to the convenience of that shape, as proved by the inn-yards and the bull-rings.

In the reign of Elizabeth, Puritan opposition to the rapidly growing drama was so active, from considerations of public health and security as well as from religious and moral feeling, that the public performance of plays was forbidden within the City of London. It occurred, therefore, to James Burbage, once a joiner by trade and then a member of the Earl of Leicester's theatrical company, to build near to London, yet outside the jurisdiction of the city fathers, a place where plays could be publicly acted. He chose Finsbury Fields, a public playground outside the walls on the north of the city, and put up there in 1576 his playhouse, the Theater, a circular wooden building with galleries all round it and an open arena on the ground, still called ' the yard ' after the inn-yards. The circle was broken only at one point, where the stage (a movable platform on trestles) projected into the yard. There was standing room for ' the groundlings ' or populace on three sides of the stage, and the galleries for the more select spectators ran round the walls and alongside of and behind the stage, occupying part of the ' tiring-house ', or actors' dressing-rooms. The theatre was open to the sky; and above the tiring-house rose a tower on which a flag was flown when a play was being acted. The English public playhouse naturally developed and changed between 1576 and the closing of the theatres in 1642; but certain features remained constant. All were circular, polygonal, or oval, and constructed principally of wood. In all, the stage projected into the yard, so that the play could be seen from three sides; in all, the galleries were reserved for those who would pay extra for seats in the ' rooms ' or boxes into which they were divided; and in all, the plays were given by daylight.

The Theater was quickly followed by the Curtain, named from the Curtain estate in Finsbury, where it stood; and the other public playhouses of the reigns of Elizabeth, James I, and Charles I were: the Playhouse, at Newington Butts; the Rose, on the Bankside; the Swan, in the same district (see *Drama* for a contemporary drawing of the interior); the Globe, which was the playhouse of Shakespeare and his company, built on the Bankside in 1599 by Richard and Cuthbert Burbage, the sons of James Burbage, mainly out of the materials of the old Theater; the Fortune, on the Bankside; the Red Bull, in Clerkenwell; and the Hope, on the Bankside.

Besides these public playhouses there were a number of ' private ' playhouses, which were only private in the sense that they were in practice reserved for the entertainment of the higher social ranks. In these we see the influence of the hall of the palace, college, or Inn of Court, where plays were acted upon the dais at one end. The private playhouse was a roofed hall, rectangular in shape, with the stage at one end. The audience was placed at the opposite end and round the walls. Some of these playhouses had galleries, and the lighting was by means of windows, supplemented, especially for stage effects, by candles. The most eminent private playhouse in London was the Blackfriars. There were three of this name within the precincts of the ancient Dominican monastery on the north bank of the Thames. The first and smallest was the theatre of the Children of the Chapel, the boys of the Royal choirs; the second was occupied by Burbage, Shakespeare, and the Globe company in the winter. Others were the Whitefriars; the Phœnix, or Cock Pit, in Drury Lane; and the Salisbury Court, in Whitefriars.

In 1642 all playhouses were closed by law. On the Restoration theatrical activity broke out anew, but was limited by the patents, or monopolies, granted by King Charles II to Sir William D'Avenant and Thomas Killigrew, the effect of which was that there were, in principle, only two theatres in London. In 1660 Killigrew built a new theatre in Vere Street, Clare Market; in November of that year D'Avenant opened at the old 'private' playhouse in Salisbury Court, moving in 1661 to a new theatre in Portugal Street, Lincoln's Inn Fields, and in 1662 to a new and splendid theatre in Dorset Gardens. Killigrew, in 1663, opened the first Theatre Royal, Drury Lane; in 1672 the house was burned down, and the new one, designed by Sir Christopher Wren, was opened in 1674. This—the theatre of Garrick—was pulled down in 1791 and rebuilt, only to be burned to the ground in 1809. Once more rebuilt, it has undergone great alterations since that date. In 1732 Covent Garden Theatre was built on the site of the present Opera House, and for about a century (Dorset Gardens having been deserted) this theatre shared with Drury Lane the theatrical monopoly of London. This house was burned down in 1808 and rebuilt. About 1720 the 'Little Theatre in the Haymarket' (so called to distinguish it from the opera house built and opened in 1705 by Sir John Vanbrugh, architect and playwright, on the opposite side of the street, where His Majesty's Theatre now stands) was opened close to the site of the present Haymarket Theatre; and this was used, by Royal licence, chiefly in the summer months when the two 'patent houses' were closed. Other theatres existed; among them the Goodman's Fields Theatre in Ayliff Street, City, opened in 1729, and rebuilt in 1782, where in 1741 Garrick made his first appearance. But such theatres had no legal status, and existed only on sufferance.

In 1737 the Licensing Act, called into being through the freedom with which dramatists, and especially Henry Fielding, were attacking the Government, made it possible for these unauthorized theatres to obtain an annual licence under stringent conditions. By complying with the provisions of the Act such theatres as Sadler's Wells (opened in 1765), the Surrey, the Olympic, and the Adelphi could attain a certain measure of security; but the two patent houses were constantly using their power to prevent rivalry from the 'minor' theatres, as they were called, and to hamper their efforts. In 1787 a determined effort was made by the actor John Palmer to maintain an unlicensed theatre called the Royalty in Wellclose Square, near the Tower of London; but the patent houses succeeded in having the theatre shut. In the 'minor' theatres performances of the legitimate drama were impossible, save by subterfuge and under disguise, or at the risk of interruption and penalty. Certain prominent theatres, however, among them those at Bath, Bristol, and Edinburgh, were granted the Royal patent in the reign of King George III. In 1843 an Act of Parliament deprived the patent houses of their monopoly. The legitimate drama was thrown open to all, subject to the licensing of every new play by the Lord Chamberlain; and very soon there was, in London and elsewhere, a great increase in the number of theatres.

In form the theatre of the Restoration carried on traditions from both the public and the private playhouses of the Elizabethan age. The drama came indoors altogether, for though the pit of Killigrew's first theatre in Drury Lane was open to the sky, it was soon covered with a glass roof. Plays were still given in the daytime, but artificial light was freely used. The theatre remained almost an amphitheatre, as the stage projected into the yard (then newly called the pit), so that people could stand or sit on three sides of it, and the galleries and boxes extended over it on either side. The pit was still the cheapest part of the house, frequented by the populace, and also by the amateur and professional critics; but the highest gallery, above the circle or circles entirely given up to boxes, began to take its place, and the social status of the pit was raised. This was partly due to the gradual substitution of the 'picture stage' for the 'platform stage' (see *Stage*), which made the stage visible only from in front and increased the size of the pit. Benjamin Webster, during his management of the Haymarket Theatre (1837–53), was the first to introduce higher-priced seats, called pit-stalls, or now more commonly orchestra-stalls, between the stage and the pit seats; and at the same theatre Mr. and Mrs. Bancroft, on opening their management there in 1880, abolished the pit, and gave the whole of the ground-floor to stalls —an innovation which was resented by the public and abandoned. The component parts of the modern auditorium are, in nearly all cases, the stalls and the pit behind them, occupying the ground-floor; a circle called the dress circle, with one or two private boxes at either end nearest the stage; above it, usually found in the older theatres, another circle, the upper circle, often called by the old name of the 'upper boxes'; and above that the gallery. Of recent years there has been a tendency to relinquish the curved, or horseshoe, design in the circles in favour of the rectangular. The fronts of the circles are brought out nearer the stage, and cross the theatre in a straight or very slightly curved line from wall to wall. This increases seating capacity, and obviates the need of more than two circles. Some modern theatres are rectangular in shape, and have either no circles or galleries, or a very small one at the back, as in the Little Theatre, London. The Birmingham Repertory Theatre, opened in 1913, is a good example of a theatre built on a German design: a rectangle divided into a ground-floor and one very deep gallery, each occupied by straight tiers of seats directly facing the stage, and sharply raked one tier above another. The introduction of the cantilever principle in building circles has enabled theatre architects to do away with pillars and other obstructions in the auditorium; and it is now possible for spectators in the remotest seats to see and hear with ease.

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Thebaine, $C_{19}H_{21}NO_3$, a very poisonous alkaloid present in small quantity in opium. It occurs in prismatic crystals of melting-point 193° C., which are nearly insoluble in cold water. It is closely related to morphine and codeine.

Thebes (thēbz), an ancient capital of Egypt, in Upper Egypt, on both sides of the Nile, now represented by the four villages of Luxor, Karnak, Medinet Habu, and Kurneh, as well as by magnificent ruins, which extend along the river. The old Egyptian name of Thebes was *Weset*, but in later times it was also called *Nu(t) Amen*, the city of Ammon,[1] or *Nu(t) ŏ*, the great city; in the Old Testament it is called *No*, or *No Amon* (*Nahum*, iii, 8; *Jer.* xlvi, 25; *Ezek.* xxx, 14, 15, 16); in the Assyrian Inscriptions it is called *Nî*. By the Greeks it was sometimes called *Diospolis*. When Thebes was founded is not known; the period of its greatest prosperity reaches from 1500 to 1000 B.C. During the reign of Akhenaten (Amenhotep IV) the capital was removed to (modern) Tell al-Amarna, or Akhetaten, where the king established a sun-cult, worshipping the *Aten* or Disk and assuming the name of Akhenaten. One of his three daughters, named Ankhesenpaaten, subsequently married Tutankhaten, later called Tutankhamen (q.v.), who ruled for a time in Akhetaten but eventually returned to Thebes.[2] The ruins comprise magnificent temples, rock-cut tombs, obelisks decorated with beautiful sculptures, long avenues of sphinxes, and colossal statues. Above Karnak are the village and temple of Luxor, the latter at one time connected with Karnak by an avenue of sphinxes (some of which still remain) about a mile long. The Memnonium or temple of Rameses II, and the temple and palace of Rameses III, on the other or left bank of the river, are objects of great interest, both for the grandeur of their architecture and the richness and variety of their sculptures. There are also the colossal statues of Amenoph III, one of them known as the vocal statue of Memnon. In the valleys of the mountains which rise behind are found the tombs of the kings, queens, and dynastic functionaries of Egypt, excavated in the living rock.

Thebes (Gr. *Thebai*), a city of ancient Greece, the principal city of Bœotia, the birth-place of Pindar, Epaminondas, and Pelopidas, was situated about midway between the Corinthian Gulf and the Eubœan Sea. Cadmus is said to have founded it in 1500 B.C., and in the legendary days of Greece it was associated with Heracles and Dionysus. It lost much of its influence in Greece through its perfidious leagues with the Persians. Under the brilliant leadership of Epaminondas and Pelopidas it became the leading state in Greece, but its supremacy departed when the former fell at the battle of Mantinea (362 B.C.). From this time the city never recovered its former importance, and gradually disappeared from history.

Theft is the appropriation of another's property to one's own use without the owner's consent. There cannot be theft of an object which has no owner, e.g. of a wild animal or of a thing which has been abandoned; but if an owner exists, though he be not known, as when an article has been lost but not abandoned, appropriation may constitute theft. Felonious intent (the 'animus furandi') is an essential element in the crime, and so it is not theft to take the use (say) of another's bicycle or of another's horse if throughout there is the intention to return it. Appropriation, i.e. taking possession, is also a necessary element. It is present if the article has merely been moved from its position with felonious intent, though the thief has been prevented from taking it away, e.g. when a watch is snatched out of the pocket of its owner but the chain holds and prevents the thief getting away with it. The true owner of stolen property can recover it even from an innocent purchaser, but in England this rule is qualified by the doctrine of 'market overt', whereby, generally speaking, a purchaser in open market who has no notice of the theft acquires a good title to the stolen property which he has thus purchased. If the theft be from the person and accompanied by threats of violence, it is the more heinous crime of robbery. Theft is punishable by fine, imprisonment, or penal servitude according to the nature and circumstances of the crime. See *Larceny*.

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[1] *Ammon* is the Hellenized form of the Egyptian *Amen*
[2] See *Tell al-Amarna*

Theism, the belief in a conscious, spiritual, ultimate reality. Etymologically, the term theism ought to be applied to the theory which affirms the existence of a divinity, irrespective of the question as to the nature of that divinity. It would thus include the doctrines of *monotheism*, *dualism*, *pantheism*, and even *polytheism*. In philosophical language, however, the term theism is only applied to the belief in an intelligent author and creator of the universe, who is not only extra-mundane, but also the providence of the world. It is the theory which explains the universe as the work of one infinite and absolute Being. Professor Flint defined theism as the "doctrine which maintains that the universe owes its existence and continuance in existence to the reason and will of a self-existent Being, who is infinitely powerful, wise, and good". Philosophically, therefore, theism is the doctrine that the ultimate ground of things is a single supreme reality. Religiously, theism is the belief in a supra-human object of worship, a Supreme Being who is at once the author, governor, and Providence of the world. It maintains not only the transcendence of God, but His immanence and agency in the world, and assumes a living constant relation between God and His creatures. It is opposed to atheism and pantheism, and is to be distinguished from *deism* (q.v.), which is natural religion and is hostile to revelation, tradition, and religious worship.

The term theism came to be used in England in the seventeenth century in contrast with deism, and in opposition to atheism. Bayle wrote in 1705: "je me sers de ce mot à l'imitation des Anglais". Greek philosophy was, generally speaking, theistic, i.e. it explained the world by assuming an absolute Being as a unifying ground of things, and a first principle. This theistic trend of thought runs through the philosophy of Plato and Aristotle, and of the Neo-Platonists. The thinkers of early Christianity, and the Schoolmen, such as Anselm and Abelard, were decidedly theists. Descartes, if we bear in mind the distinction between theism and deism, was a deist, and *not* a theist. Kant, in his *Critique of Pure Reason*, distinguished between the deist and the theist by saying that the former believes in God, whilst the latter believes in a living God (*summam intelligentiam*). Lotze in Germany, and Martineau and Caird in England were theists, whilst William James, the champion of pluralism (q.v.), considers theism as the "only conception of God which will satisfy our emotional and volitional nature". With regard to the proofs adduced in favour of the existence of God, they have been: (1) *cosmological*, arguing from the existence of a dependent world to an independent cause; (2) *teleological*, arguing from the evidences of plan and design in the world to the existence of a First Cause which is a rational personality; (3) *moral*, arguing from the nature of man himself as a moral being to that of God; and (4) *ontological*, maintaining that it is inconceivable that the conception which man forms of God should be a mere subjective creation.—BIBLIOGRAPHY: R. Flint, *Theism*; G. J. Romanes, *Candid Examination of Theism*; A. J. Balfour, *Theism and Humanism*.

Theiss (tīs), a river of Central Europe, formed by the confluence of the Black and the White Theiss, descending from the Carpathians, and flowing into the Danube about 20 miles above Belgrade; length, about 800 miles. Its principal tributary is the Maros, which joins it near Szeged, and which is navigable by steamers as far as Arad.

Thelephoraceæ, a family of basidiomycetous Fungi, having membranous or leathery fruit-bodies of various shapes. *Thelephora terrestris* sometimes overwhelms Conifer seedlings. Stereum is another genus.

Themis, goddess of law and justice among the Greeks, was, according to the Hesiodic theogony, the daughter of Urănus and Gē (Heaven and Earth). According to Pindar, she was the wife and chief adviser of Zeus.

Themis'tocles (-klēz), Athenian statesman, born 514 B.C., died 449 B.C. On the second invasion of Greece by Xerxes, Themistocles succeeded by bribery in obtaining the command of the Athenian fleet, and in the battle of

Salamis which followed (480 B.C.), the Persian fleet was almost totally destroyed, and Greece was saved. The chief glory of the victory is due to Themistocles. Subsequently he was accused of having enriched himself by unjust means, and of being privy to designs for the betrayal of Greece to the Persians. Fearing the vengeance of his countrymen, he, after many vicissitudes, took refuge at the Persian court. The Persian throne was now (465 B.C.) occupied by Artaxerxes Macrocheir (Longimănus), to whom Themistocles procured access, and whose favour he gained by his address and talents, so that he was treated with the greatest distinction. He died, according to some accounts, by his own hand.

The′obald (often pronounced tib′ald), Lewis, English man of letters and editor of Shakespeare, born about 1688, died in 1744. He was educated for the law, but early turned his attention to literature. Pope was meanly jealous of him, and ridiculed him in the first version of *The Dunciad.* Theobald, however, had his revenge, his edition of Shakespeare (1733) completely supplanting Pope's. He did great service to literature by this painstaking work, many of his emendations being adopted by subsequent editors, and gaining for him the title of ' splendid-emendax '.

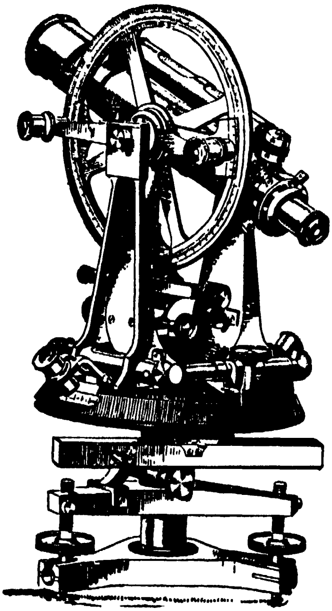
Theoc′racy (Gr. *theos*, god; *kratein*, to rule), a system of government of which the chief is, or is believed to be, God himself, the priests being the promulgators and expounders of the divine commands. The most notable theocratic government of all times is that established by Moses among the Israelites.

Theoc′ritus, the creator of pastoral poetry, lived in the third century B.C. Very little is known of his life, nor is that little beyond suspicion. He is said to have been the son of Praxagoras and Philinna, and to have been a Syracusan, or, as others say, a Coan settled in Syracuse. He was a pupil of the Homeric critic Philetas, who died of vexation because he could not solve a metaphysical enigma. It has been conjectured that Ptolemy Philadelphus was Theocritus's fellow-pupil, and that the poet owed to this a semi-official position as court-poet at Alexandria. It is believed that he returned to Cos and spent his latter days there. He died there at an advanced age.

Thirty poems (*Idylls*) have come down to us under the name of Theocritus. Some of these are without doubt spurious, and the authenticity of many of them has been called in question, not always for sufficient reasons. Style and treatment are uncertain tests of authenticity; a criticaster of A.D. 4200 could prove that *The Idylls of the King* and *The Northern Farmer* could not possibly be the work of the same man. As is natural, the most masterly poems are beyond question genuine. The ancient arrangement of the poems is not a satisfactory one, but it is too long established to be lightly altered. The poems may be divided into four classes: (1) Bucolics and mimes, the former being true pastorals, the latter realistic poems of contemporary town life. Sophron, whose works are lost, influenced Theocritus in the composition of his mimes. (2) Epyllia, or epics in miniature. Several of these are official poems, in praise of Hiero and Ptolemy. They are mere ormolu work in comparison with the pure gold of the pastorals. (3) Lyrics. One of these is a very graceful piece of occasional verse, which accompanied a distaff presented to the wife of his friend Nicias. (4) Epigrams. None of these is distinguished, and few are genuine.

Theocritus's great reputation rests upon his pastoral poems and his mimes. One of the latter, *The Women at the Adonis Festival*, has acquired a certain fame because it was translated by Matthew Arnold. This poem is wholly delightful, but is not typical of its author's genius, which is akin to that of Virgil or of Tennyson, not to that of Herodas (q.v.) or of Mr. F. Anstey. *The Spell*, the Second Idyll, is a poem of great power. *The Cyclops* is a fine poem, in which the Homeric cannibal roars as gently as any sucking dove. But the purely pastoral poems, of which No. 7, *The Harvest Home*, is the most charming, are Theocritus's great contribution to poetry. Living in an age of grammarians and diaskeuasts, Theocritus struck a new and rich vein of genuine poetry. He has had many followers—Virgil, Calpurnius Siculus, Guarini, Mantuanus, Spenser, Gay, to name but a few—but none of them has equalled or even approached him in felicity of language, sweetness of song, and truth to nature. See *Pastoral.*—BIBLIOGRAPHY: R. J. Cholmeley, *Theocritus*; P. E. Legrand, *Étude sur Théocrite.* There is an excellent verse translation by C. S. Calverley (q.v.), and a prose one by Andrew Lang. Much of the verse translation in the Loeb Library is in what the Host in *The Canterbury Tales* called "rym dogerel".

Theod′olite, a surveying instrument invented by Jonathan Sisson, a celebrated mathematical-instrument maker of the beginning of the eighteenth century. The name theodolite is due to the English mathematician Leonard Digges, who described a simple form of the instrument in a work published in 1571. As now greatly improved, it is the most perfect instrument for measuring both horizontal and vertical angles, and is employed in all important surveying work. In the original type, called the *plain theodolite*, the telescope moved through an arc of about 45° only, upwards or downwards; in the later type, called the *transit theodolite*, the telescope may make a complete revolution. As the latter is now almost universally adopted, it is the one which will be described. The instrument when in use is mounted upon a very rigid tripod-stand, to which it screws. It consists of a powerful telescope trunnioned to make a complete revolution in a vertical plane, and supported in uprights which are so mounted on centres as to allow it to make a complete revolution in the horizontal plane also. Both vertical and horizontal centres carry circles or limbs divided upon silver with the utmost attainable accuracy, and the readings of the various angles are taken by means of double concentric centres, one carrying the divided circles and the other carrying verniers.



Stanley's Transit Theodolite

The movements of the telescope in altitude or azimuth are read by microscopes mounted to move over the verniers, the fineness of the readings varying, with the size of the circles used, from 1 minute of arc with a 4-inch circle to 5 or 10 seconds with a 6-inch, and single seconds with a 10- or 12-inch circle. Both the vertical-circle vernier arms and the horizontal-circle vernier cover plate carry very sensitive level tubes which are most accurately ground and filled with ether, so that the instrument may be set up by means of the levelling screws absolutely horizontal and vertical, and all the movements of circles and telescope are controlled by clamps and tangent motions for fine adjustment. The telescope is fitted with a diaphragm across which are stretched fine lines, usually pieces of spider's web, forming the index lines to which the readings are taken. A magnetic compass is attached for the purpose of orientation, and with high-class instruments a transverse stage is fitted above the levelling screws for accurately centring the instrument over a given spot. An illustration is given of the most usual form of simple field instrument. For high-class geodetic work a much more elaborate type of instrument is used.

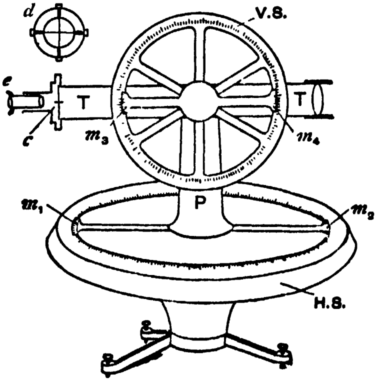


Diagram illustrating the Principle of a Theodolite

HS is a brass plate fixed firmly to a pedestal which rests on three foot-screws. By means of these the plate can be accurately levelled, two spirit-levels at right-angles to each other being fixed on the plate for the purpose. Standing vertically on the plate is a support P. This support is pivoted so as to turn round a vertical axis, and it carries as it turns two opposite verniers, m_1, m_2, rigidly fixed to it. These verniers run along a scale of degrees engraved on a silver ring let into the brass plate HS. Fixed immovably to P is a double arm carrying verniers m_3, m_4. Supported by P, but pivoted so as to be able to turn in vertical plane is a telescope T, to the axis of which is firmly fixed a vertical circle of brass, also with a silver ring divided into degrees. At the focus *c* of the eyepiece *e* of the telescope are two fibres of spider-web in the form of an exact cross, called the cross-wires (shown separate at *d*). These are fixed to an adjustable metal ring within the tube of the telescope, and are arranged with one wire vertical, the other horizontal, and the cross in the optic axis.

Theodo'ra, the wife of the Byzantine emperor Justinian I (q.v.), at one time a dancer on the stage, and notorious as a courtesan. She subsequently assumed the character of a pious benefactor of the Church, and died in 548, aged forty.

Theodore II, King of Abyssinia, born 1818, died 1868. For many years a rebel, he battled his way to the throne (1855), and as king was an inveterate enemy of Islamism, an able and versatile ruler, and a reformer of note. His egotism eventually manifested itself in despotic tyranny. He fell during the storming of Magdala. See *Abyssinia.*

Theodore of Mopsuestia, the most distinguished ecclesiastical writer of his age, born at Antioch about A.D. 350, died in 428. He was ordained priest, and distinguished himself as a zealous opponent of the heresies of Arius, Apollinaris, and others. From Antioch he removed to Tarsus, and was chosen Bishop of Mopsuestia, in Cilicia (about 392–4). Only a few fragments of his works, which included commentaries on almost all the books of the Bible and various polemical treatises, are extant. His doctrine approximated somewhat to that of Pelagius, and was later considered heretical.—Cf. A. Harnack, *History of Dogma.*

Theod'oret, Greek Church historian and theological writer, born at Antioch about A.D. 386, died in 457. In 423 he became Bishop of Cyrus or Cyrrhus, was involved in the quarrel between Nestorius and Cyril of Alexandria, and was deposed at the so-called Robber Council of Ephesus, a sentence which was reversed by the General Council of Chalcedon in 451. The most important of his works consist of commentaries on numerous books of the Old Testament and on the Pauline epistles, *Ecclesiastical History, History of Heresies,* &c.

Theodor'ic, King of the Ostrogoths, born A.D. 455, died 526. The son of Theodemir, King of the Ostrogoths of Pannonia, he lived from his eighth to his eighteenth year as a hostage with the Emperor Leo at Constantinople. Two years after his return he succeeded to the throne. In 493, after several bloody engagements, Theodoric induced Odoacer, who had assumed the title of King of Italy, to grant him equal authority. The murder of Odoacer at a banquet soon after opened the way for the proclamation of Theodoric as sole ruler, and as such he ruled with great vigour and ability. He attached his soldiers by assigning them a third part of the lands of Italy, on the tenure of military service; while among his Italian subjects, whom he conciliated by introducing an improved administration of justice, he encouraged industry and the arts of peace. Although, like his ancestors, he was an Arian, he never violated the peace or privileges of the Catholic Church.

Theodo'sius, a Christian Roman emperor, born in Spain about A.D. 346, died at Milan in 395. In 379 he was selected by the Emperor Gratian for his partner in the empire. To his care were submitted Thrace and the eastern provinces, which he delivered from an invasion of the Goths. On the defeat and death of Maximus (388), Gratian having previously been killed, Theodosius became the sole head of the empire. In 390, as punishment for a revolt in Thessalonica, he caused the people of the city to be invited to an exhibition in the circus, and, once there, 7000 of them perished at the hands of his soldiery. St. Ambrose refused him communion for eight months on account of this crime, and Theodosius submitted humbly to the punishment. He died of dropsy, leaving the eastern portion of the empire to his son Arcadius, the western to his son Honorius. Theodosius distinguished himself by his zeal for orthodoxy.

Theognis of Megara, Greek elegiac poet, lived in the sixth century B.C. Very little is known of his life, though several imaginative biographies of him have been written. What we do know of him is mainly derived from the poems (some 1400 lines in all) that have come down to us in his name. There is no doubt, however, that many of these poems are not his work, though authorities differ about which are genuine and which are not. It seems certain that he lived at Megara in the disturbed times which followed the overthrow of the tyrant Theagenes, and that he was a keen party-politician, and a member of the ascendancy party. Oligarchy and democracy were engaged in a fierce struggle, members of the latter party demanding a παλιντοκία, or retrospective abolition of interest. Theognis was driven from the city, and visited Eubœa and Sicily. Many of the poems of Theognis are addressed to one Cyrnus, who was, in accordance with a Dorian custom, his pupil or squire. For the most part they consist of precepts; they are in fact a kind of *Proverbial Philosophy* of the sixth century B.C. They are devoid of almost all the higher qualities of poetry; had Theognis lived at a later date he would almost certainly have written in prose. Xenophon has well said of him that "he discourses of nothing else but the virtue and vice of men, and his poetry is a Manual on Man, just as if anyone skilled in horsemanship were to write a Manual of Horsemanship". His poems are full of practical wisdom, and, as might be expected, were favourite textbooks in schools. Among his sayings are, that poverty breaks the spirit of a noble man more than anything, more even than age or ague; and that at a dinner-party one should strike a happy mean between the two extremes of teetotalism and intoxication. He was one of the earliest eugenists, for he wrote: "We are careful to select the best race of horses and the like, but a noble man doubts not about marrying a mean woman, if she bring him money".

Theology is, etymologically, the science of God, i.e. the reasoned study of the divine nature. This is its original sense, in Greek. But as the divine nature was regarded in all its relations to the world and to man, 'theology' came to mean the reflective statement of religious realities. "Theology is religion brought to self-consciousness. It is the reflective analysis of the consciousness of God in its distinctive form, and in its connection with all our other consciousness of reality." (E. Caird, *Evolution of Theology in the Greek Philosophers*, vol. i, p. 31.) Religion is the sphere in which theology operates. The data of the religious experience, the intuitions, emotions, and beliefs generated in the human mind by the idea of God, furnish the material for theology, which analyses and correlates and classifies them, in order to bring out what is implicit and to reach a unified view of their truth.

Theology thus presupposes a theory of knowledge, and all fruitful theology is connected with some philosophical view of reality. The important changes which have taken place in theology have been due in part to revivals in the practical religious experience, which have demanded new statement of belief; but they have also been the result of some fresh idea in philosophy which has affected the expression of religious truth.

How far theology is to be identified with the philosophy of religion is a debated question. The answer largely depends upon the range assigned to 'theology'. In the broadest sense of the term, theology becomes practically a philosophy of any given religion, developing the reasons for its beliefs and practices, and justifying, in terms of contemporary philosophy, its essential principles. But the traditional division of 'theology' and philosophy goes back to the assumption of a revealed, supernatural content, and demands a narrower definition. Theology, in this sense, is the reasoned explanation of faith as the outcome of a divine revelation. It includes (*a*) *natural* theology, i.e. the religious truths about God which are accessible to the natural reason, secured by a survey of life and the world. From the data of nature and the moral life certain inferences are drawn as to the existence and character of God. Then (*b*) *revealed* theology amplifies this body of inferences by working upon the direct revelation of God in a sacred book or a sacred personality like that of Jesus Christ. (*c*) One branch of this is called *biblical* theology, since its particular data are the recorded statements of the Bible as the inspired book of Christians. (*d*) The exegetical results of this study are employed by *systematic* theology, which arranges them in a dogmatic system. (*e*) *Historical* theology shows how these ideas have worked during the course of the history of the Church; and finally (*f*) *practical* theology explains how the clergyman, in his varied avocations, employs them for the use of Christian people.

The determining factor in theology is, therefore, that of the being and nature of God. How God is knowable; what are the limits of religious knowledge; how God is revealed to men—these are the fundamental ideas. "First, there is in the mind a certain vague unresolved feeling and consciousness of God; second, this resolves itself and breaks up into separate individual sentiments, passing over into ideas, opinions, convictions, beliefs. This is the sphere of religion. Third, this mass of individually distinct beliefs is again bound, by passing some principle through them, into a new unity. And this is theology." (A. B. Davidson, *Biblical and Literary Essays*, p. 2.) Theology is impossible without theism, and it varies with the particular form of theism which is adopted. The strain of theology lies in its relation to religious intuition on the one hand, and to the reflective reason on the other. The conception of God given in intuition or in emotional religious experience has to be correlated with the data of reflection; neither intuition nor reason must be undervalued. And it is repeatedly found that the adjustment is difficult. Intuitive knowledge of God, which is unreflective, often implies a view of God which is deeper than the religious person realizes; it is the task of theology to bring this to consciousness. On the other hand, the construction of theological reflection has to be kept in close touch with the living data of the religious consciousness, otherwise there is a danger of theology becoming unduly speculative. In one sense, this strain is no more than that between the two impulses in life for goodness and for truth. But it is a strain which is specially severe in theology, and a strain which cannot be evaded, except at the cost of vitality. Theology is rooted in religion. Yet it cannot dispense with a philosophy, any more than it can afford to identify itself with any particular philosophy.—BIBLIOGRAPHY: James Drummond, *Introduction to the Study of Theology* (1884); A. M. Fairbairn, *The Place of Christ in Modern Theology* (1893); C. Gore, *Belief in God* (1920).

Theophrastus, the successor of Aristotle at the Lyceum, was born 372 B.C., and died 287 B.C. He was a native of Eresus, in the Island of Lesbos. His father was a fuller by trade. He studied philosophy under Plato at the Academy, and became the intimate friend and favourite pupil of Aristotle, who gave him the name of Theophrastus on account of his graceful eloquence. His original name was Tyrtamus. When Aristotle left Athens for Chalcis in 322 B.C., Theophrastus became Principal of the Peripatetic School, over which he presided until his death. He was a popularizer of science rather than an original thinker. He added much to the fame of the Lyceum, acquired a great reputation, and was given a public funeral. Menander (q.v.) was one of his pupils.

Theophrastus took all knowledge for his province. He specialized in polymathy, which, according to Heraclitus, does not educate the mind. His lost works include: *On Animals which change their Colour*, *On Solecisms*, *On Drunkenness*, *On the Education of Children*, *A History of Geometry*, and *On Music*. His extant works consist of: *On Sensuous Perception*, *On Metaphysics* (a fragment), *A History of Plants*, *On the Causes of Plants*, *On Stones*, *On Winds*, *On Weather Signs*, and the *Ethical Characters*. The botanical writings of Theophrastus are seldom read, even by professional scholars; his reputation rests almost entirely upon his *Characters*. This work consists of thirty brief and trenchant sketches of different types of men—the Boor, the Superstitious Man, the Late Learner, the Coward, and so on. It has been frequently imitated, e.g. by Hall (1608), Sir Thomas Overbury (1614), Bishop Earle (1628), and La Bruyère (1688). Theophrastus provides a curious example of how a literary reputation may survive. It is as if a Professor of Universal Knowledge at Oxford or Cambridge should be remembered mainly by his occasional contributions to *Punch*.—Cf. Sir R. C. Jebb, *The Characters of Theophrastus* (text, notes, translation, and elaborate introduction, the whole revised by Sir J. E. Sandys).

Theory of Functions of a Complex Variable. A complex number, sometimes called an imaginary number, has the form $a + b\sqrt{-1}$, where a and b are real numbers. Complex numbers make their first appearance as roots of quadratic equations. The square of every ordinary number, positive or negative, integral or fractional, is a positive number. Hence no negative number has a square root if the numbers at our disposal are all ordinary (or *real*) numbers. We may, however, introduce a symbol $\sqrt{-1}$, without defining its meaning, but subjecting it to the conditions that it is to be combined with itself and with real numbers by the ordinary laws of algebra, and that its square is to be -1. We thus, it is found, add immensely to the symmetry and completeness of algebra. Every quadratic equation has now two roots, equal or unequal, real or imaginary; and, more generally, every rational integral equation (q.v.) of degree n has exactly n roots. An important example is the equation $x^n = 1$. It can be shown that $(\cos 2r\pi/n + \sqrt{-1}\sin 2r\pi/n)^n = 1$, this being a special case of the very important result in trigonometry known as De Moivre's Theorem, which is that $(\cos A + i \sin A)^n = \cos nA + i \sin nA$, where i is, as usual, written for $\sqrt{-1}$. Thus we obtain n nth roots of 1, by giving r the values $0, 1, \ldots, (n-1)$ in the expression $\cos 2r\pi/n + i \sin 2r\pi/n$.

Great advantages are gained by allowing the variable or argument, on which mathematical functions depend, to assume all values whatever, real or imaginary. The foundations of the theory based on this idea were laid a hundred years ago by Cauchy. Many mathematicians have contributed to its development, notably Riemann and Weierstrass, and its bounds are still extending rapidly. Its processes are marked by extraordinary power and beauty, and with its help it is a matter of the greatest ease to solve many problems that are quite intractable by analysis restricted to real variables.—Bibliography: G. Chrystal, *Algebra*; T. M. Macrobert, *Functions of a Complex Variable*; A. R. Forsyth, *Theory of Functions of a Complex Variable.*

Theosophy (Gr. *theos*, god; *sophia*, wisdom), a term applied to various cults and conceptions of divinity. It denotes knowledge of God obtained by direct intuition of the divine essence. It is at once related to and distinguished from both theology and philosophy, the former dealing with knowledge of God obtained by revelation, the latter with knowledge obtained by reasoning. Max Müller (*Theosophy or Psychological Religion*) defined theosophy as "expressing the highest conception of God within the reach of the human mind, and the perception of the eternal oneness of human and divine nature". Its knowledge is intuitive and not based on facts accessible to any ordinary intelligence. Theosophy is not a modern movement, and its origin may be traced to India, which is its home. The doctrine of an immediate intuition of the divine nature is found in Brahmanism; in the Upanishads; in the Hindu philosophical schools of Vedanta, Sankhya, and Yoga; in Neo-Platonism; in Jewish-Greek philosophy; and in the Cabbala. It was subsequently developed in the teaching of Paracelsus, of Eckhardt, Tauler, and especially of Jacob Boehme.

In modern times the term theosophy is applied to a form of belief promulgated by Mme Blavatsky (q.v.) (1831-91). She gave out that she had received her doctrines from certain masters, or mahatmas, who had reached a higher plane of existence and of spiritual development, and who had communicated to her the true solution of the problems of the universe. Modern theosophy claims to be at once a religion, a philosophy, and a science. It is a science based on the investigation of the occult laws of nature, laws grasped only by those who are qualified for inquiry, and who, in consequence of their knowledge, obtain superhuman powers. Modern theosophy studies nature, but it studies it for the purpose of discovering the mysterious Being whom nature both hides and reveals. It accepts the universal truths common to all religions, as the founders of all religions were inspired men, masters, whose teaching came from the same source, divine wisdom. Religiously, theosophy teaches the unity of God, the manifestation of God as a Trinity, and the existence of a graded order of intelligences. It proclaims the doctrine of incarnation and the law of *karma.* Ethically, theosophy is altruistic, and preaches the gospel of universal brotherhood. Philosophically, it is idealistic, and scientifically, it investigates the superphysical world, but by senses which 'respond to vibrations of matter'. Man is supposed to be septuple, i.e. he is composed of seven parts, four being the physical man, and three the spiritual. According to Mrs. Besant, the two fundamental truths of modern theosophy are: (1) the transcendence and immanence of God; and (2) the solidarity and brotherhood of all human beings, i.e. "man's identity of nature with God, and man's identity of nature with all around him". In 1875 (17th Nov.), in New York, Mme Blavatsky and Colonel Olcott formed the Theosophical Society for the following purposes: (1) to form a nucleus of a universal brotherhood of humanity without distinction of race, sex, creed, caste, or colour; (2) to encourage the study of comparative religion, science, and philosophy; (3) to investigate the unexplained laws of nature and the powers latent in man. The new movement has now spread all over Europe, and its adherents endeavour to offer to humanity a new philosophy which renders life intelligible.—BIBLIOGRAPHY: H. P. H. Blavatsky, *Secret Doctrine*; *Key to Theosophy*; A. Besant, *Popular Lectures on Theosophy*; C. W. Leadbeater, *Outline of Theosophy*.

Therapeu'tæ, a Jewish ascetic sect, similar to the Essenes (q.v.), described by Philo Judæus in his work *De Vita Contemplativa.* The sect originated in the neighbourhood of Alexandria, especially on the shores of Lake Mareotis. Recluses, ascetics, celibates, and mystics, the Therapeutæ lived on semi-monastic lines, divested themselves of all their worldly possessions, renounced their families, and retired from the world to solitude, where they led a studious life. It was held for a long time that Philo had described Christian monks, but modern scholars are of opinion that a Jewish sect of Therapeutæ really existed.

Therapeutics (from θεραπεύω, meaning, *I treat* or *heal*) would appear to comprehend the whole aim of inquiry and practice in the medical sciences. Yet, paradoxically, it is only within living memory that any considerable advance has been made towards placing the study upon a scientific footing. This becomes the more intelligible if we consider that disease is but a deviation from the normal animal physiology, more or less profound and inimical to the continuance of healthy function, and that a rational system of treatment must necessarily comprehend the means of reversing this deviation, which are rarely to be found in ignorance of its precise nature. Massage as a therapeutic measure is not peculiar to human beings, and the conscious search for the means of alleviating suffering or of promoting health or fertility is of early origin in human society. The wearing of clothing is now held to have had its origin in the use, by the pre-dynastic Egyptians, of cowrie shells, symbols of life-giving. The ancient Greeks collected simples, which they applied internally and externally for the relief of the symptoms of disease, and it was from lists of these that the earliest pharmacopœia was compiled. Philtres, draughts, potions, charms, and spells are interwoven into the social as well as the medical history of the Middle Ages, and the long association of medicine with learning laid an enormous mass of information, largely spurious, on the threshold of the nineteenth century. So recently as Huxley's student days, the science of drugs was little more than a vast accumulation of inconsiderable facts which the science of chemistry was soon to drive from the armamentarium of the physician. Thus the twin sciences of therapeutics and pharmacology (φάρμακον = a drug) fell into a well-merited disrepute from which they are only beginning to recover. The view, cynical or sane, according to individual opinion, is still held that the drugs which are of use in the treatment of disease can be counted on the fingers, and certainly iron, arsenic, mercury, antimony, opium, digitalis, ipecacuanha, strychnine, quinine and the salicylates, a few anæsthetics, and the chief purgatives—some of these either wholly new additions to the pharmacopœia or now administered in new compounds by new methods—do not constitute a large inheritance from past centuries. These are life-saving and pain-preventing remedies in their proper uses; curative too in all but the strictest sense of the term, for it is doubtful whether every morbid condition, once established in the body, does not influence, in a manner varying from the extreme of incapacity to the extreme of inconsequence, the subsequent history of the organism. But in recent years the attitude towards therapeutics, and particularly pharmacology, has undergone a profound change. Professor Dixon, of Cambridge,[1] who has summarized the chief causes of this change, draws attention to experimental observations, such as Magendie's on the action of strychnine; Bernard's on curare; Fraser's on strophanthus, a cardiac tonic similar in its action to digitalis; and the varied experiments with the alkaloid, quinine, isolated from cinchona bark by Pelletier and Dumas in 1820. As factors in modern advancement he instances further the new relationships between pharmacology and physics and chemistry, in regard to the chemical structure of the molecule and the physical processes of adsorption, surface tension, and solution; the physiological discovery of the internal secretions of the body, to all intents and purposes drugs within the animal economy (adrenalin, thyroidin, pituitrin), which has opened up a wholly new chapter in biology and therapeutics alike; and lastly the enormous advances made in the study of the body tissues and fluids, and their activity in the establishment of immunity to specific infections. If we exclude surgery, itself a branch of therapeutics, attaining its ends through changes in the gross structure of the body, the older art of treatment was almost wholly empirical; the new tends more and more to be rational. This is true even while the use of some drugs, and among them not the least valuable, is still purely empirical.

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[1] Article 'Pharmacology and Therapeutics' in Sir George Newman's memorandum on *Medical Education in England* H.M. Stationery Office, 1923.

The new therapeutics thus tends to be divided into subdivisions of the subject, corresponding with subdivisions of physiology. Following upon the brilliant work of Metchnikoff and Ehrlich and a host of other workers on immunity, the new science of *immunology* has already enriched medicine with a large number of diagnostic reactions—for use, for example, in typhoid (Widal); food-poisoning (Gaertner); dysentery (Shiga and Flexner); pneumonia, diphtheria (Schick); spotted-fever, cholera, syphilis (Wassermann); tuberculosis (Calmette, Von Pirquet, and Moro)—and vaccines, antitoxins, and antibacterial sera. The name of Sir Almroth Wright is prominently associated with this development of immunology, the triumph of typhoid inoculation during the Great War serving still further to draw attention to his methods. These advances, in themselves positive, have led to others. Thus the ill-effects which have followed the injection of serum (anaphylactic shock) have paved the way to a wider knowledge of natural protoplasm poisonings to which some persons are peculiarly susceptible, e.g. asthma, and pointed the way to the cure of the resulting morbid conditions.

Again, the ductless glands of the body, the chief ' regulators of metabolism ' as they have been called, are better understood in their chemistry and physiology than formerly, and an extensive *organotherapy* is in consequence developing, providing us with new powers of control over disease. Examples are the use of thyroid extract in myxœdema and cretinism, both diseases of thyroid insufficiency or deficiency; of adrenalin in the treatment of exhaustion and shock; of pituitrin in midwifery; and, still more recently, of insulin, a pancreatic extraction, in the treatment of diabetes.

Under the heading of specifics comes the large number of synthetic drugs provided by the co-operation of German science, chemical and medical, and industry. ' Salvarsan ', dihydroxy-diamino-arsenobenzene, Ehrlich's six-hundred-and-sixth experimental anti-syphilitic drug, is but an indication of the possibilities of the modern pharmacology in relation to therapeutics. It is to be regretted that there is not yet established in this country an institute of experimental therapeutics comparable with that of Ehrlich in Frankfurt.

Electricity, X-rays, and radium are at present empirical remedies in disease; but as the outcome of modern science and research they should be mentioned; the physiology and pharmacology of anæsthetics is a rapidly advancing study; psycho-therapy is the application of recent additions to our knowledge of human psychology, many of them important, to morbid mental and physical states; while in *heliotherapy* we have an example of the curative uses of man's natural environment, a complex and powerful determinant of his vital courses of which all too little is known with accuracy.—BIBLIOGRAPHY: Clark, *Applied Pharmacology*; Cushny, *Pharmacology and Therapeutics*; Osborne, *Principles of Therapeutics*; Musser and Kelly, *Practical Treatment*.

There'sa, St., Spanish nun, born at Avila in 1515, who took the veil among the Carmelites at the age of twenty-four. Being dissatisfied at the relaxation of discipline in the order to which she belonged, she undertook to restore the original severity of the institute. The first convent of reformed Carmelite nuns was founded at Avila in 1562, and was speedily followed by a number of others. She died in 1582, and was canonized by Pope Gregory XV in 1621. She was the author of several works, all of a devotional nature, among them a very curious life of herself.

Therezina, a city of Brazil, capital of the state of Piauhi, on the Parnahyba. There is a sugar-refinery, and cotton and soap-making industries. Pop. 50,000.

Thermal Conduction, one of the three methods by which heat (q.v.) passes from one point to another. In an unequally heated body, all the points which at a given moment have a given temperature V lie on a surface, called an *isothermal* surface. The *flux* of heat at a point P, i.e. the quantity of heat which flows per unit time across unit area of the isothermal surface through P, is equal to the product of the temperature gradient at P by a constant called the *conductivity* of the material of the body; the temperature gradient being the rate of fall of temperature per unit length along the normal to the isothermal. If the conductivity is k, the heat crossing any area dS in time dt is therefore $-k(dV/dn)dSdt$, where $-dV/dn$ is the rate of fall of temperature per unit length in the direction perpendicular to dS. In a rectangular element of volume with one corner at (x, y, z) and with sides dx, dy, dz, it is easily shown (see *Potential* for the method) that the net heat acquired in time dt is $k(d^2V/dx^2 + d^2V/dy^2 + d^2V/dz^2)dxdydzdt$. If s is the specific heat per unit mass, ρ the density, and dV the rise of temperature of the element $dxdydz$ in time dt, the heat used in raising the temperature is $s(\rho dxdydz)dV$, and this is equal to the net heat taken in. Hence, dividing by $dxdydzdt$, we have

$$dV/dt = (k/s\rho)(d^2V/dx^2 + d^2V/dy^2 + d^2V/dz^2).$$

This is the equation on which Joseph Fourier based his beautiful work, the *Théorie Analytique de la Chaleur*, to the inspiration of which a great part of the mathematics of the last hundred years is directly due. One of Fourier's solutions was applied by Lord Kelvin to the determination of the age of the earth from observations of underground temperatures. His result was far below the period claimed by geologists, but the discovery of the perennial radiation of heat by radio-active bodies in the earth's substance has made Kelvin's analysis obsolete, and given the geologists more than their revenge.—Cf. H. S. Carslaw, *Fourier Series and Integrals, and the Theory of Conduction of Heat.*

Thermal Value of Fuels. When fuels are purchased, it is the possible production of heat which is paid for. It is therefore important that the thermal or calorific values should be tested, and the purchase decided from the standpoint of cheapness of heat production, other factors being equal. In actual practice the factors which must be considered are the quantities of ash produced, and the presence or absence of constituents injurious to the continued use of the plant. For fuel-testing, instruments known as calorimeters are available for the combustion of known amounts of the fuel and the determination of the quantity of heat produced. In those used for coal, the fuel after powdering is made into a pellet, and is ignited by contact with an incandescent platinum wire, and burned inside a glass vessel supplied with an atmosphere of oxygen and surrounded by a measured quantity of water. The heat given up in the burning of the weighed amount of coal may be measured by noting the rise in temperature of the water, and allowing for that taken up by the instrument. It is customary to assess the instrument as being equivalent to an additional amount of water, known as the water equivalent, in its heat-absorbing actions. Certain refinements are necessary if accuracy is essential, such as allowances for radiation. For very accurate work, great care is taken in measuring the heating actions with highly heat-insulated instruments, known as bomb calorimeters. In gas-testing, the rate of burning is kept uniform, and the heat is used to raise the temperature of water flowing at a constant velocity in or around tubes in the instrument. Oils may be dealt with in either the same way as coal, with the use of an absorbent pellet of known calorific value, or as a gas, with the oil burner and container suspended to the one arm of a balance to facilitate the measurement of the usage.

In every case there are two calorific values to be considered, because the hydrogen in the fuel unites with oxygen to form water. If it passes away in the form of steam, it will not give up its latent heat for useful employment, but if it is condensed to the liquid form it will do so. In consequence there are the net and the gross values to be considered, according to the conditions of the combustion.

Chemical analysis, to obtain the proportions of the carbon, hydrogen, and oxygen in the fuel, may be used as a preliminary to the calculation of the calorific value, but allowances must be made to cover the heat used in splitting up the structure of the fuel and dividing up or decomposing the chemical combinations it contains. The subject of heat values is of some interest for the general public, for their gas bills are now dealt with on the basis of the available heat contents of the combustible.

Thermidor (Gr. *thermē*, heat; *doron*, gift), the eleventh month of the year in the calendar of the first French Republic. In the years I–VII it extended from the 19th July to 18th Aug., and in the years VIII–XIII from the 20th July to 19th Aug.

Thermochemistry, a branch of physical chemistry concerned with the heat changes—evolution and absorption—which are associated with chemical processes. The main general principles of the subject are simple deductions from the law of the conservation of energy, but a good deal of experimental work on the thermal accompaniments of chemical action had been done before 1850, the date at which the consequences of Joule's epoch-making measurements may be considered to have become fully recognized. Among early workers the most notable were Thomas Andrews (q.v.) and G. H.

Hess (1840). To Hess is due the *law of constant heat sums*, according to which the total heat effect in a given chemical change is the same, no matter by what separate steps the final change is brought about. This law is still used to determine heats of formation (see below), when these cannot be found by direct experiment. Julius Thomsen and M. P. E. Berthelot stated a *principle of maximum work*, which asserts that every spontaneous chemical action is accompanied by evolution of heat, never by absorption. This principle, although applicable in the great majority of cases which occur in practice, is not universally true; it is indeed obviously inconsistent with the well-known fact that certain reactions can be reversed by slight modification of the conditions. The true criterion which determines whether a given reaction will or will not take place spontaneously, though also a principle of maximum work, is somewhat more recondite than Berthelot's law; it depends on the second law of thermodynamics (q.v.).

When two elementary substances unite so as to form a more or less stable compound, the heat evolved, which is usually expressed in calories, is called the *heat of formation.* We meet with such equations as

$$\begin{aligned} C + 2O &= CO_2 + 94{,}300 \text{ cals.,} \\ \text{and} \quad CO + O &= CO_2 + 68{,}000 \text{ cals.} \end{aligned}$$

The first equation means that 12 grammes of carbon (the atomic weight of carbon being 12) unite with 32 grammes of oxygen to produce 44 grammes of carbon dioxide, with the evolution of 94,300 calories of heat; or, in other words, that carbon and oxygen, in uniting to form 44 grammes of CO_2, lose intrinsic energy of amount 94,300 calories. By subtraction, we find from the two equations the loss of intrinsic energy in passing from $C + 2O$ to $CO + O$; that is to say, the heat of formation of CO is 94,300 — 68,000, or 26,300 calories. Most substances have *positive* heats of formation, and these are called *exothermic*; but some substances, called *endothermic*, give out heat when they are decomposed, so that their heats of formation are negative. Endothermic substances, among which are acetylene, hydriodic acid, nitrous and nitric oxides, and nitrogen trichloride, are unstable to a greater or less degree, some of them being liable to break up into their elements with a violent explosion.

The *heat of combustion* of an organic substance is the amount of heat evolved when the carbon and hydrogen of the substance are oxidized completely to carbon dioxide and water, under defined conditions. From the heat of combustion of a substance its heat of formation can be deduced indirectly. Methane, for example, an important constituent of gaseous fuels, burns in accordance with the equation

$$CH_4 + 4O = CO_2 + 2H_2O + 213{,}800.$$

But the heat of formation of CO_2 is 94,300 calories, and that of liquid water is 68,300 calories. Hence the production of $CO_2 + 2H_2O$ should be accompanied by the evolution of 94,300 + 136,600, or 230,900 calories. The deficit 230,900 — 213,800, or 17,100 calories represents the heat already used up as the heat of formation of CH_4 from its elements.

Other sections of thermochemistry deal with *heat of solution*, the heat developed when a substance combines with water to form a hydrate; and *heat of neutralization*, the heat given out when an acid combines with a base to produce a salt. When a powerful monobasic acid, such as HNO_3 or HCl, unites with a strong monacid base, like NaHO or KHO, the heat developed is in all cases approximately the same, viz. about 137,000 calories.

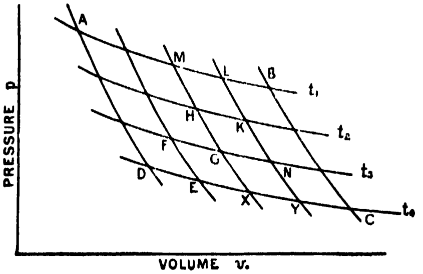
Thermodynamic Engine, any type of engine in which the heat energy contained in the working substance is partly converted into mechanical energy. Steam, gas, or the other substances employed are in popular use, because of the convenience of the utilization of the heat they contain. The efficiency of an engine is the ratio of the heat converted into work to that taken into the engine. Only a limited proportion of the heat contained in the working substance can be utilized, as the operations are governed by the two temperatures of heat reception and rejection. The limit of possible efficiency is given as the ratio of the difference of temperature between inlet and exhaust to the absolute temperature of inlet. That value can only be attained when all the heat is received at the high temperature, and all the heat rejected is sent away at the low temperature and the cycle of operations is reversible. It is attainable in Carnot's and certain other cycles, but is not obtained from a steam-engine with a separate boiler and condenser, or indeed with any practical engine. For purposes of comparison, the Rankine or Clausius cycle is used as a basis for steam-engines. In it the normal compression bringing back the working substance to its entrance conditions is eliminated, and exhaust continued until the end of the stroke. It is a cycle of possible practical achievement, and is therefore a more suitable standard for an actual steam-engine.

Thermodynamics, in the original and more restricted sense of the word, is a branch of physics which deals with the relations between heat and mechanical energy, and with the conditions under which either may be converted into the other. The science is based on two empirical laws, called the *first* and *second laws of thermodynamics*, and its main conclusions are deduced from these laws by a process of pure reasoning, without further appeal to experiment. Since these laws apply to the relations of heat to other forms of energy (e.g. electrical or chemical energy) besides mechanical energy, or work, the word thermodynamics has in modern practice come to be used in an extended sense as including the whole body of physical and chemical doctrine resting upon either or both of the two laws. The *first law* is simply the principle of the conservation of energy (see *Energy, Physical*). The *second law* has been stated in various forms. As put by Clausius it runs: It is impossible for a self-acting machine unaided by any external agency to convey heat from one body to another at a higher temperature. Both laws are of the negative type; the first denies the possibility of creating or destroying energy, the second the possibility of transforming heat into work in a particular way. It has been said that the laws deny the possibility of *perpetual motion* of the *first* and of the *second* kinds.

The science was founded by Sadi Carnot, who, in his *Étude sur la puissance motrice de la chaleur*, was the first to make a positive deduction from the negation involved in the second law. Carnot introduced the important idea of a *cycle*, i.e. a series of changes in which the initial and final states of the body or system considered are identical.

Carnot's Cycle.—Take unit mass of any fluid, which may be a liquid in contact with its saturated vapour, but which for simplicity we shall suppose to be a gas. We are to subject this fluid to certain changes of volume, pressure, and temperature, so that it may be called the *working substance*. The changes are supposed to take place so slowly that at any given moment the temperature of the body may be regarded as the same throughout. In these circumstances the state of the body is completely defined if we know any two of the three variables, its pressure, volume, and temperature. We shall suppose that the pressure and volume are the two independent variables chosen. Any state of the body is then represented by a point on the *p*, *v* diagram (see figure). Let the body be taken through a cycle specified by the path ABCD. From A to B the body is supposed to expand at constant temperature or *isothermally*; from B to C no heat is allowed to enter or leave, in which case the expansion is said to be *adiabatic*; from C to D the body is compressed at a constant temperature, which is lower than the original temperature; and from D to A the body is compressed adiabatically. The series of changes thus defined constitutes the *Carnot cycle*. The final state of the body is exactly what it was originally; what has happened is that a certain quantity of heat Q_1 has been taken in at the higher temperature T_1, another quantity of heat Q_2 has been given out at the lower temperature T_2, and a certain amount of external work has been done, represented, as can easily be proved, by the area ABCD. By the first law, the quantity of heat $Q_1 - Q_2$ which has gone out of existence is mechanically equivalent to the work done by the working substance.

A very notable feature of Carnot's cycle is that it is a *reversible* one. The whole process could be carried out backwards, the working substance being at any particular stage in the same state as at the corresponding stage in the original process. This reversibility is essentially due to the fact that at every point of the cycle the body is in a state of equilibrium, that is, a state in which it would remain permanently, did we not start a change, by just increasing the pressure for instance, or just lowering the temperature. Carnot's great contribution to thermodynamical theory was his proof that no engine working between a given upper and lower temperature can be more efficient (that is to say, can produce more work for a given intake of heat) than a *reversible* engine working between the same temperatures, and hence that the efficiencies of all reversible engines working between stated limits are the same. Carnot proved this by showing that if it were not so, we could imagine a combined arrangement in which the given reversible engine would be driven backwards by the other, so that in every cycle a certain net amount of heat would be taken in at the lower temperature, and rejected at the upper, without any energy being supplied from outside. This conclusion is directly contrary to the second law. Hence, in all reversible engines working on the Carnot cycle between given temperatures, whatever the working substance and the design may be, the ratio of the work done to the heat taken in is the same. But



Adiabatics and Isothermals

since the work done is equivalent to the difference between the heat taken in and the heat rejected, it follows that the ratio of heat taken in to heat given out depends only on the two temperatures. Further, it can be shown that this ratio has the form of the ratio of a function of the one temperature to the same function of the other. To prove this, consider the part of the figure between the isothermals t_1, t_3, and the adiabatics MHG, LKN. Let the quantities of heat taken in along ML, HK, GN be Q_1, Q_2, Q_3 respectively. Then, as has just been shown, Q_1/Q_3 depends only on the temperatures t_1, t_3; and Q_2/Q_3 only on t_2, t_3. By division, it follows that Q_1/Q_2 is the ratio of a function of t_1, t_3 to a function of t_2, t_3; and t_3 must divide out, since Q_1/Q_2 is independent of t_3; hence Q_1/Q_2 is the ratio of a function of t_1 alone, to a function of t_2 alone.

This very important result led Lord Kelvin to the definition of an *absolute temperature* scale. It is to be observed that although we are able to give exact definitions of many special temperatures, such as the temperature at which pure water boils at a stated pressure, there is nevertheless an element of arbitrariness about the *numbers* which we shall attach to these temperatures. It so happens (see *Heat*; *Thermometer*) that the laws of expansion of liquids and gases under increase of temperature, at constant pressure, or, more generally, the laws connecting the pressure, volume, and temperature of a given mass of gas, are approximately so simple and uniform that liquid and gas thermometers of many different types give closely accordant results. On Kelvin's scale, however, the results are absolutely identical, no matter what the working substance may be. His definition is that the numerical values of temperatures are to be so assigned that, in the notation used at the end of the preceding paragraph, $Q_1/Q_2 = T_1/T_2$. To make this definition perfectly precise, it is added that the difference of the numbers representing the ordinary fixed points of the mercury thermometer is to be 100. Kelvin showed, partly by mathematical analysis and partly by experiments carried out in conjunction with Joule, that the absolute scale differs very little from the scale of the constant-volume hydrogen thermometer. Experiments on actual substances show, indirectly, that when T_1 and T_2 are the boiling- and freezing-points of water, then Q_1/Q_2 has the value 373·1/273·1. These numbers differ by 100, so that the freezing-point of water on the absolute (centigrade) scale is 273·1; or, if we change the origin to the freezing-point of water without changing the numbers for intervals of temperature, then the absolute zero is −273·1° C. Since $(Q_1 - Q_2)/Q_1 = (T_1 - T_2)/T_1$, and $Q_1 - Q_2 = W$, the work done by the reversible engine, it follows that the efficiency of the engine is $(T_1 - T_2)/T_1$. If $T_2 = 0$, this fraction is 1, so that all the heat taken in from the source is converted into work, if the condenser is at absolute zero.

The existence of the function of the state of the body called the *entropy* (see *Entropy*; *Steam-engines*) can now be proved. Let a body, the states of which are represented in a p, v diagram, intersected by isothermal and adiabatic lines (see figure) pass reversibly from the state D to the state B along any path made up of parts of isothermals and adiabatics, e.g. the path DEFGHKLB. Let the quantities of heat taken in along the isothermal intervals DE, FG, HK, and LB be q_4, q_3, q_2, q_1 respectively, the corresponding absolute temperatures being t_4, t_3, t_2, t_1. Then we can determine the heat taken in if the body is made to pass from the state D to the state B along the path DXYCB. For heat along EX/heat along FG $= t_4/t_3$ so that heat along EX $= q_3t_4/t_3$. Similarly along XY and YC, the heat taken in is q_2t_4/t_2 and q_1t_4/t_1. Let us now take D to be a standard state, and *define* the *entropy* at B as the fraction (heat taken in along DC)$/t_4$, a perfectly definite quantity when the states D and B are given. Then what we have *proved* is that the entropy of B $= q_4/t_4 + q_3/t_3 + q_2/t_2 + q_1/t_1$. Similarly, entropy at F $= q_4/t_4$, so that entropy at B − entropy at F $= q_3/t_3 + q_2/t_2 + q_1/t_1$. In words, if a body pass from one state to another by a path made up of parts of isothermals and adiabatics, then the increase of its entropy is the sum of the fractions (heat taken in)/(absolute temperature), taken for all the isothermals.

It is easy to deduce a corresponding result for the case when the passage from one state to another (say F to B) is effected by any reversible path whatever. In this case, entropy at B − entropy at F $= \int dq/t$, the integral being taken along the given reversible path, where q is the net quantity of heat taken in from the initial point F up to the point where the temperature is t; and dq is the differential of q. The existence of a function of state, the entropy φ, with the property $d\varphi = dq/t$, is for a single body the exact equivalent of the second law; just as the existence of the energy E is equivalent to the first law. All the properties of a single body which can be proved by thermodynamics are deducible by pure mathematics from the existence of the energy and the entropy.

Closely related to entropy are the ideas of *availability* and *dissipation* of energy. A quantity of heat q has the energy value q, whatever may be the absolute temperature t of the body from which this heat is taken. But only a fraction of this value q is available for conversion into work, or *mechanical* energy. In fact, if t_0 is the temperature of the coldest body which can be used as condenser, then qt_0/t units of heat are given out at t_0, and are of no further use for the production of work; they are said to have been *dissipated.* The remainder, viz. $(1 - t_0/t)q$ units, is the quantity originally *available.* In the ordinary processes of nature, frictional effects, and the exchanges of energy between the parts of a system which is not in equilibrium, are powerful agents continually at work in the dissipation of energy. These latter effects increase the entropy of a system—if we define this to be the sum of the entropies of its parts—without altering the energy. When, for example, q units of heat pass by radiation from a body at temperature t to another body at t_0, the entropy of the first body diminishes by q/t, while that of the second increases by q/t_0; and, since t_0 is less than t, the total entropy is increased.

The tendency for the entropy of an isolated system to increase led Boltzmann to speculate on the relationship between the entropy and the *probability* of a given state of the system. Without attempting any precise definition, we may see in a general way that there is some sort of connection between the two, since both tend to a maximum as the system tends to its final state of stable equilibrium; and since entropies are additive, and probabilities are combined by multiplication, the entropy may be expected to be proportional to the *logarithm* of the probability.

The earliest applications of thermodynamics had reference to the more purely physical properties of bodies, and to the theory of heat engines. Important applications were afterwards made by Helmholtz, Willard-Gibbs, and others to physical chemistry. Helmholtz introduced the idea of *free energy,* which is found more convenient by the chemist than that of *entropy.* When a physico-chemical system passes from one state of equilibrium to another, a certain amount of energy is either disengaged or has to be supplied, the amount varying with the circumstances under which the change takes place. If the change is made *reversibly,* then the mechanical energy obtainable from the change has its greatest possible value, this being a consequence of the second law. This maximum amount of disengaged mechanical energy is what Helmholtz calls the free energy of the given reaction or change. Thermodynamical methods occupy a prominent place in modern discussions of such subjects as the equilibrium of homogeneous systems and the theory of valency.

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Thermoelectricity, that branch of electricity which deals with currents produced by heat from two dissimilar metals. Seebeck discovered (1821) that when one junction of two metals, such as copper and iron, is heated while the other junction is kept cool, an electric current flows round the circuit, passing from copper to iron through the hot junction. The current increases with the difference of temperature of the junctions. If the junction is made colder than the rest of the circuit, the current will flow in the opposite direction. Metals may be arranged in such order that each is thermoelectrically positive to the following metal. If one of the metals is lead, the electromotive force of the pair per degree C. is called the thermoelectric power of the second metal. This is a small number, which is usually expressed in microvolts per degree C. Thus bismuth has a thermoelectric power of about 93, and antimony of about −24; if the junction bismuth-antimony is used, its power is 93 + 24, or about 117 microvolts per degree C.

Thermoelectric Inversion.—Cumming discovered that the thermoelectric property of a pair of metals may be inverted at high temperatures. To illustrate this, let one junction of a copper-iron pair be steadily raised in temperature while the other is kept at 0° C. The E.M.F. of the pair will increase to a maximum at 275°, and will become zero at 550° C. If the junction is raised above 550°, the E.M.F. and current will be reversed or inverted. In general, there is no current if the average temperature of the two copper-iron junctions is 275° C. This is called the *neutral temperature* of the couple; that of zinc-iron is about 200° C.

Thermoelectric Diagram.—If the thermoelectric powers of different metals are plotted against the temperatures, a thermoelectric diagram is obtained which gives the neutral temperature of any pair; the E.M.F.'s for different ranges of temperature are represented by areas on the diagram.

Peltier Effect.—Peltier found (1834) that when a current from a battery is passed through a junction of two unlike metals, the junction is heated or cooled according to the direction of the current. Thus, when the current flows from bismuth to antimony, the junction is cooled and heat is absorbed. The quantity of heat energy, expressed in ergs, which is absorbed when one coulomb flows through the junction is called the Peltier coefficient (P), and the total energy absorbed by i amperes in t seconds is Pit ergs.

Thomson Effect.—Thomson discovered (1846) that when a current flows along a wire heated at one place, say, by a flame, there is absorption of heat on the one side and liberation of heat on the other side, the effect being as if the current carried heat with it.

E.M.F. of a Thermocouple.—Let the two junctions of a couple with thermoelectric power p at 0° and neutral temperature N° be at temperatures $T°$ and $t°$. Then the relation between the E.M.F. E and the temperatures has been shown by Tait to be $E = p(T - t)\{1 - \frac{1}{2}(T + t)/N\}$. With some pairs the simpler formula $\log E = A \log(T - t) + B$ has been found to hold; A and B are constants to be determined for the given pair of metals.

Thermopile.—By placing a number of pairs in series, with one set of junctions exposed to heat and the other set kept cool, the E.M.F. at disposal may be greatly increased. Such an arrangement is called a thermopile; it was invented by Nobili, and was employed in conjunction with a galvanometer by Melloni as a detector and measurer of radiant heat. Thermoelectric batteries were once used for the direct conversion of heat into electric energy. The most successful of these was Clamond's; the elements were tin and an alloy containing two parts of antimony and one of zinc. The heating was done by coal-gas, and a battery of sixty pairs gave an E.M.F. of 8 volts, with an internal resistance of 1½ ohms. The gas consumption was 8 cubic feet per hour. The thermojunction has been employed by Boys in the radiomicrometer as a delicate detector of radiant heat, by Rubens in the linear thermopile for examination of heat spectra, and by Duddell in the thermogalvanometer for measuring small oscillatory currents such as are used in telephony. The most important practical use of the thermocouple is its application to the measurement of temperature (see *Pyrometer*).

Thermometer, an instrument for measuring temperature. Methods of measuring temperature are based on the different effects of heat. In one method, use is made of the expansion of a liquid within a glass vessel; in another, the expansion of a gas is employed; in a third, the gas is kept at constant volume, and the change of temperature is found from the change of pressure of the gas; in a fourth method, advantage is taken of the change of electrical resistance of a metal with change of temperature, or of the thermoelectric properties of metals; and in a fifth, the temperature is measured by means of the radiation emitted by the hot body. Of these methods the first, exemplified by the mercury thermometer, is the most convenient and compact for ordinary uses; the second and third give us, in the gas thermometers, our standard methods of measuring temperature; whilst the fourth and fifth methods, typified by the platinum resistance thermometer, the thermoelectric couple and the radiation pyrometer, constitute the only means of measuring very high temperatures (see *Pyrometer*).

Mercury Thermometer.—To make a mercury thermometer, a glass bulb is welded to a capillary glass tube of uniform bore. The bulb is then heated, and on dipping the end of the tube under mercury, the cooling of the tube causes a little mercury to be drawn into the bulb. On boiling this mercury, all the air is driven out, and on again dipping the end of the tube under mercury, the metal fills the bulb and stem. Some mercury is then driven off, and the tube is sealed. On placing the thermometer in melting ice, and afterwards in the steam of water boiling at 76 cm. pressure, the temperatures 0° C. and 100° C., or 32° F. and 212° F., are marked, and the stem between the marks is then divided into 100 equal parts in the case of the centigrade thermometer, or into 180 equal parts for the Fahrenheit scale. A Réaumur thermometer is similarly dealt with, and the interval between the fixed points divided into 80 equal parts. By comparing these scales, we may find that the temperature F. corresponding to a given temperature C. or R. is given by $F - 32 = 9C/5 = 9R/4$, an equation which enables us to convert from one scale to either of the others. The mercury thermometer has a fairly wide range; the boiling-point of mercury is about 357° C., but by using hard glass, and filling the space above the mercury with nitrogen or carbon dioxide at about 20 atmospheres pressure, the range of the thermometer has been extended to 550° C. Fused silica is now used in making high-temperature mercury thermometers. Since mercury freezes at −39° C., and atmospheric temperatures of −80° C. have been recorded, other liquids are used for low-temperature measurement.

Alcohol Thermometer.—Alcohol has a low freezing-point (−112° C.) and a coefficient of expansion about six times that of mercury, and it is used in certain forms of thermometer for measuring low temperatures. *Pentane* has been employed in thermometers reading to −190° C.

Maximum and Minimum Thermometers.—These are instruments for registering the highest and lowest temperatures which occur during the day and night. In one form, that of Six, the tube contains alcohol separated into two portions by a column of mercury which occupies a bend in the tube. At one end of the tube the alcohol occupies a large bulb, and at the other end a smaller bulb is incompletely filled with the alcohol. Two small iron wires rest on the mercury surfaces. With rise of temperature, expansion takes place towards the smaller bulb, and one index is pushed up the tube by the mercury. If cooling takes place, the index is left behind, and its lower end records the highest temperature reached; it may be replaced by using a small horse-shoe magnet. The minimum temperature is recorded in a similar manner by the displacement of the other index. In Negretti and Zambra's maximum thermometer there is a constriction of the bore above the bulb, and after expansion has taken place, the column of mercury is left behind, and the maximum temperature is read from the top of the column.

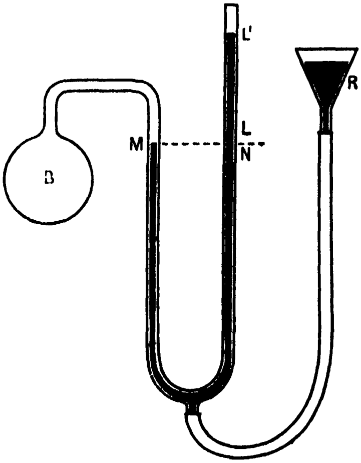
Clinical Thermometer.—A small Fahrenheit thermometer with a range from 95° to 110° is used by medical practitioners and others to find the temperature of the human body. It is a maximum thermometer on the same principle as the previous one.

Gas Thermometers.—As the result of experiments designed to test the suitability of various substances for thermometric purposes, Dulong and Petit concluded that the change of volume of the permanent gases was proportional to the heat absorbed, but that this was not the case with solids and liquids. In addition, gases have a high coefficient of expansion and low thermal capacity, and they maintain the same physical properties through a wide range of temperature. For these reasons *hydrogen* is chosen as the standard thermometric substance, and changes of temperature are *defined* as being proportional to the corresponding changes of pressure which take place in a mass of hydrogen kept at constant volume.

Constant-volume Gas Thermometer.—The bulb B (see figure) is filled with dry gas and immersed in melting ice, the mercury being adjusted to a mark M by means of the reservoir R. The level of the mercury L in the open manometer tube is noted, as also the barometric height H. The bulb is then immersed in steam from water boiling at normal pressure; the mercury is again adjusted to the mark M, and the new level L′ of the mercury is noted. The height LL′ gives the change of pressure for 100° C., and the degree is defined as that change of temperature which causes 1/100th of the change of pressure which results when the gas is heated at constant volume from the melting-point of ice to the boiling-point of water. The height $H + LN$ is proportional to P_0, the pressure of the gas at 0° C., and $H + L'N$ to P_{100}, the pressure at 100° C., and any temperature t for which the observed pressure is P_t, is found from $t/100 = (P_t - P_0)/(P_{100} - P_0)$, or from $P_t = P_0(1 + \alpha t)$, where α is 1/273·0 for hydrogen, air, and nitrogen.

Constant-pressure Gas Thermometer.—If the gas is kept at constant pressure, changes of temperature may be determined from the changes of volume of the gas by using the corresponding law of expansion: $V_t = V_0(1 + \alpha t)$. A simple form of air thermometer may be constructed by enclosing air in a long uniform tube, closed at one end, by means of a globule of mercury. An air thermometer of this kind was used by Galileo. A more complicated form is in use for standard purposes.

The gas thermometer is not adapted for ordinary use; besides, at very low temperatures difficulties appear, as the gases then approach their critical temperatures and deviate from Boyle's law. For such cases, the electrical methods of measuring temperatures are superior. At high temperatures the bulb gives trouble; bulbs made of hard glass may be used up to 500° C.; porcelain bulbs are unsatisfactory beyond 1100° C., and platinum or platinum-iridium bulbs filled with nitrogen are used instead, since hydrogen passes through the metal at high temperatures.



Constant-volume Gas Thermometer

Thermonatrite. See *Trona.*

Thermop′ylæ, a narrow defile in Northern Greece, leading from Thessaly southward, between Mount Oeta and the sea (the Maliac Gulf, now the Gulf of Lamia), 25 miles north of Delphi, celebrated for its defence by 300 Spartans, together with allies, under Leonidas, against the Persian host under Xerxes, in 480 B.C.

Thermostat, a contrivance for keeping an enclosure at a constant temperature. Many different designs are in use, the simplest and commonest depending on the expansion of a liquid or gas with rise of temperature. In one arrangement, when the temperature reaches a certain point, the liquid (e.g. toluene) closes an orifice by which the gas supply must enter. When the temperature falls again, the liquid recedes and the flow of gas recommences. A by-pass prevents the gas from ever being completely extinguished.

Theromorpha, or **Anomodontia**, an important order of extinct reptiles, characteristic of Permian and Triassic times. In the wide range of their types of teeth, and in some features of the skeleton, they foreshadow the structure of the mammals. The small form Tritylodon from the Trias of Southern Africa, with multituberculate molar teeth, was at first described by Owen as a mammal.

Theseus (thē′sūs), a mythical king of Athens and famous national hero of antiquity. He was the unacknowledged son of Ægeus by Æthra, the daughter of Pittheus of Troezen, in Peloponnesus. Brought up by his mother, he came afterwards to Athens, where he was acknowledged by his father as son and successor. Many notable deeds are related of him, as the slaying of the Minotaur and the freeing of Athens from the tribute of seven youths and seven maidens annually sent to Crete to be devoured by that monster. As King of Athens he is reputed to have governed with mildness, instituted new laws, and made the government more democratic. —Cf. J. E. Harrison, *Mythology and Monuments of Ancient Athens*.

Thespis, a native of a village near Athens, who lived in the sixth century B.C., reputed to be the inventor of tragedy and of the masks which the Greek actors always wore in performing. His first representation took place about 535 B.C.

Thessalonians, The Epistles to the. Thessalonica, the modern Salonika, had been evangelized by St. Paul and two colleagues during his first mission to Europe. The work at Thessalonica had been short and successful, but stormy. Jewish opposition drove Paul reluctantly away. He desired to keep in touch with the local Church in its inexperience and difficulties, and therefore wrote from Corinth the 'First Epistle'. Timotheus, who had been able to remain longer at Thessalonica, had brought him news of the Church, which was being not only persecuted but exposed to insidious slanders against Paul's character. He writes (*a*) to hearten the local Christians in view of their troubles, and (*b*) to repudiate the insinuations against himself. A third (*c*) object is to calm their minds about death. Some of their number had died, in the interval, and Paul explains that this does not exclude them from their share in the glory of the Second Advent. He also warns the survivors against restlessness and excitement, caused by their very hope in the near approach of the Second Advent. The first two topics are interwoven in i, 2 to iii, 13. The third is inserted (iv, 13 to v, 11) in a general instruction upon the moral responsibilities of Christians (iv, 1 to v, 28).

Shortly afterwards the apostle found himself obliged to send a second epistle to correct some further misapprehensions about the Second Advent. The Thessalonian Church was not disturbed by any doctrinal controversies over the Law. The danger lay in an unregulated hope of the Second Advent, which was producing a morbid condition in many of the members. The main object of the 'Second Epistle' is to warn the Church that the Second Advent cannot take place until a certain lawless force breaks loose; then matters will come to a head, in the providence of God. But till then the Church is to attend to its duties quietly. The problem of the 'Second Epistle' lies in the statement (ii, 3–12) about this lawless force, and the restraint at present holding it in. Probably the apostle anticipates a false Messianic movement within Judaism, which will challenge Jesus Christ, and the 'restraining' power is the Roman Empire; so long as that Empire lasts, with its protection of Christians against Jewish malevolence, the supernatural apostasy could not make headway, but, once it is removed, the final clash will come. The apostle therefore anticipates darkness before the dawn. But he is sure of the final victory of Christ, and bids the local Christians be patient and steadfast meanwhile.

Both epistles are written in the name of Paul, Silvanus, and Timotheus—the three original founders of the Thessalonian Church (*Acts*, xvii, 1–9, 15; xviii, 5)—but Paul is the real author. Suspicions of the authenticity of the 'Second Epistle' were once current, but are now almost entirely abandoned. The only literary problem is whether the second was not written before the first; but the internal evidence is against this. The similarities and differences between the two epistles may be fairly explained on the hypothesis that Paul wrote them in their present order, in rapid succession, as practical religious problems emerged in the local Church.

If not the earliest, they are among the earliest extant epistles of the apostle. The only one which may have been written earlier is *Galatians*.

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(1908), and Professor J. E. Frame (*International Critical Commentary*, 1912). The epistles are discussed in biographies of St. Paul, and good notes are provided by B. Jowett in his *St. Paul's Epistles to the Thessalonians*, &c. (1894, third edition); and Bishop Lightfoot in *Notes on Epistles of St. Paul.* (1895)

Thes'saly, a north-eastern division of Greece, mainly consisting of a rich plain enclosed between mountains and belonging almost entirely to the basin of the Peneus or Peneios (Salambria), which traverses it from west to east, and falls into the Ægean through the vale of Tempe. Thessaly and Macedonia lead Greece in cereal production. Minerals, especially chrome ore, are exported by Volo (q.v.), the chief port. Live-stock is raised. Larissa and Trikkala (where lignite is found) are other important towns.

Thessaly was conquered (352 B.C.) by Philip of Macedon. Macedonia was annexed to and was finally incorporated with the Roman Empire. After the fall of the Byzantine Empire it came into the hands of the Turks, but the greater portion of it was incorporated (1881) with the Kingdom of Greece.

Thetford, a municipal borough of Norfolk, England, on the Ouse. The manufacture of agricultural implements, brewing, and tanning are the chief employments. Pop. (town), 4700; (rural district), 9360.

Thetford, an industrial town of Quebec, Canada, in Megantic county; served by the Quebec Central Railway. It has asbestos-mines (near by), foundries, and many other industries. Pop. 8000.

Thetis, a Greek divinity, a daughter of Nereus and Doris, therefore one of the Nereids. By Peleus, to whom she was married, she became the mother of Achilles. Her nuptials with Peleus were celebrated on Mount Pelion, and were honoured by the presence of all the gods except Eris or Discord, who was not invited, and who, to avenge the slight, threw in among them the apple of discord. She is represented in Homer as living with her father in the depths of the sea.

Thian-shan (tē'an-), or **Celestial Mountains**, a range of Central Asia, extending from the Pamir Plateau into the Desert of Gobi. Its length is estimated at 1500 miles, and many of its summits rise to 16,000 or 17,000 feet, far beyond the limits of perpetual snow.

Thielt, a town and railway junction of Belgium, in the province of West Flanders. Manufactures include linens, cottons, woollens, lace, and liquor. Pop. 11,605.

Thiepval, a village of France, in the department of Somme. It was entirely destroyed during the European War. A stone tower (a replica of the celebrated Helen's Tower, Clandeboye, County Down, the subject of poems by Tennyson and Browning) commemorates the attack of the 36th (Ulster Division) on 1st July, 1916. See *European War.*

Thierry (ti-er-ri), Jacques Nicolas Augustin, French historian, born 1795, died 1856. He was for some time secretary to Saint-Simon, whose socialistic views he embraced, but he did not fail to perceive the theoretical vagaries of his master, from whom he separated in 1817. His great work *Histoire de la conquête de l'Angleterre par les Normands*, published in 1825, attained great success both in France and in England, and although he became blind (1826), his *Lettres sur l'histoire de France* appeared in 1827. In 1834 he published *Dix ans d'études historiques*, a series of admirable essays, and about the same time he was summoned to Paris by Guizot, then Minister of Public Instruction, and entrusted with the editing of the *Recueil des monuments inédits de l'histoire du tiers état*, for the collection of documents relative to the history of France. In 1840 he published *Récits des Temps mérovingiens.*

Thiers (ti-âr), Louis Adolphe, French statesman and historian, born at Marseilles 1797, died 1877. He studied law, and at the age of twenty-two was admitted advocate. He soon relinquished law, however, for literature and politics (1821). Going to Paris, he began to write for the *Constitutionnel* and other journals, and during the years 1823 to 1830 made a great reputation as a political writer. He was at the same time engaged on his *Histoire de la Révolution française*. Taking part with Armand Carrel and Mignet in the foundation of the *National* (1830), he subsequently assisted in editing it, strongly advocating constitutional liberty in its columns. During the July Revolution of 1830 the office of the *National* was the head-quarters of the revolutionary party, and in the government of Louis Philippe Thiers held several offices, till in 1840 he found himself at the head of the ministry for a few months, and then retired into private life. After the Revolution of 1848 he was elected Deputy to the Assembly, and voted for the presidency of Louis Napoleon, but was ever after one of his fiercest opponents; and at the *Coup d'État* (2nd Dec., 1851) he was arrested and banished. Returning to France in the following year, he remained in comparative retirement till 1863, when he was elected one of the Deputies for Paris. During the terrible crisis of 1870–1 he came to the front as the one supreme man in France. After the fall of Paris he was returned to the National Assembly, and on 17th Feb., 1871, he was declared chief of the executive power. The first duty imposed upon him as such was to assist in drawing up the treaty of peace, whereby France lost Alsace and Lorraine and agreed to pay an enormous indemnity; his second was to suppress the Communist insurrection, which broke out within three weeks of the signing of the treaty. This done, his next task was to free the soil as quickly as possible from the invaders by the payment of the ransom, which also was effected in an incredibly short space of time. The Assembly in Aug., 1871, prolonged his tenure of office and changed his title to that of President. In Nov., 1872, Thiers declared himself in favour of the republic as a definitive form of government for France, and thus to some extent brought about the crisis which resulted in his being deprived of the presidency. He accepted his deposition with dignity, and went quietly into retirement. His chief works are *Histoire de la Révolution française* (6 vols., 1823–7) and *Histoire du Consulat et de l'Empire* (20 vols., 1845–62).—BIBLIOGRAPHY: François Le Goff, *The Life of Louis Adolphe Thiers*; J. F. Simon, *Adolphe Thiers*; P. de Rémusat, *Thiers*.

Thiers (ti-ăr), a town of France, in the department of Puy-de-Dôme, on a hill washed by the Durolle; served by the Lyons Railway. It has manufactures of cutlery and ironmongery, paper, candles, leather, &c., water being the source of power. Pop. 17,437.

Thio-alcohols, Thio-ethers, a group of sulphur compounds analogous to the monohydric alcohols and to the ethers. *Mercaptan*, $C_2H_5{\cdot}HS$, which corresponds to ethyl alcohol, $C_2H_5{\cdot}HO$, behaves as a weak acid and forms salts called *mercaptides*, especially mercury compounds, whence its name *corpus mercurio aptum*. The thio-ethers or alkyl sulphides, e.g. ethyl sulphide, $(C_2H_5)_2S$, are liquids of an unpleasant, piercing, leek-like odour.

Thionville (ti-on̦-vēl; Ger. *Diedenhofen*), a town and railway junction of France, in the department of Moselle (q.v.), on the Moselle. Taken by the Prussians on 25th Nov., 1870, it remained in their hands until 1918. Pop. 12,000.

Thirlmere, a lake of Cumberland, England, the main reservoir of the water-supply of Manchester.

Thirlwall, Connop, English bishop and historian, born 1797, died 1875. Educated at the Charterhouse and at Trinity College, Cambridge, he passed from a brilliant university career to the law, but entered the Church and was ordained in 1828. His first important work was a translation of Schleiermacher's *Gospel of St. Luke* (1825), which was followed by a *History of Greece*, the first edition appearing in Lardner's *Cabinet Cyclopedia*, between 1835 and 1840. Before the appearance of Grote's history it was without a rival in the English language. In 1840 Thirlwall was presented by Lord Melbourne to the see of St. David's, which he held till within little more than a year of his death. In conjunction with Archdeacon Hare, Thirlwall published a translation of the second version of the first two volumes of Niebuhr's *Roman History*. He was a member of the committee for the revision of the Old Testament.

Thirsk, a market town of England, in the North Riding of Yorkshire. It consists of old and new towns, separated by the Codbeck. Manufactures include agricultural implements, flour, and leather. Pop. 3000.

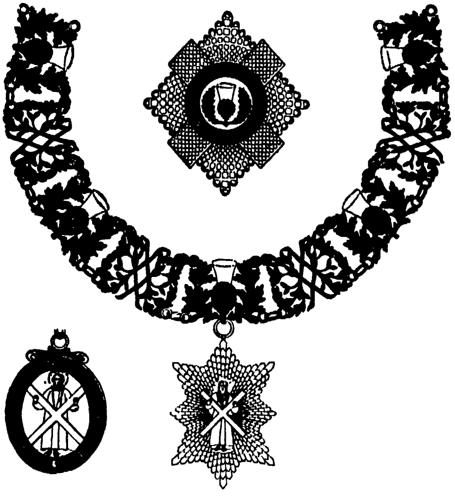
Thirty Years' War. The Thirty Years' War (1618–48) originated in the questions which were left unsettled at the time of the Reformation in Germany, but its duration was prolonged by French intervention, and its later stages were an episode in the conflict between France and the Habsburgs. The agreement made at Augsburg (1555) between the Catholics and the Lutherans in Germany was based upon the right of the ruler of a state to determine its religious complexion (*cujus regio, ejus religio*); it necessarily made no provision for the later Protestant development inspired by the creed of Calvin; and it left uncertain many questions connected with Church property, and especially with the possessions of secularized bishoprics. There were several occasions before 1618 when a religious war seemed to be imminent, and the rival parties were grouped into the Calvinist Union (1608) and the Catholic League (1609). The final crisis came with the accession to the Habsburg dominions (including Bohemia) of a ruler, Ferdinand of Styria, who was a bigoted Catholic and unlikely to continue the toleration which the Bohemian Protestants had secured from his predecessor, the Emperor Rudolf II. The Estates of Bohemia recognized Ferdinand as heir to the crown in 1617, but the Protestants rebelled, and (23rd May, 1618) threw the two regents of the kingdom out of a window in the palace at Prague. They appealed to the natural leader of the German Calvinists, Frederick V, Elector-Palatine, a son-in-law of James I of England, who, without the consent of James, promised to accept the Bohemian throne. The death of the old Emperor Matthias, in March, 1619, was followed by the election of Ferdinand as emperor in August, and in the same month the Bohemian Estates elected Frederick as King of Bohemia. A year later the Bohemians were defeated in the battle of the White Mountain (8th Nov., 1620). Frederick fled, and the Bohemian rebellion was suppressed. The conflict might have ended with this incident, but the emperor declared that Frederick had forfeited his own territory of the Palatinate, and conferred it upon his ally, Maximilian of Bavaria. This was a challenge to the whole of

German Protestantism, besides offending Spain and England, and from the Bohemian revolution developed a European war. Other German princes came to Frederick's help, James I gave him some assistance, which was increased by Charles I in 1625, and Christian IV of Denmark, who was interested in two secularized German bishoprics, became the leader of the Protestant cause. The first great Protestant effort was defeated by two great imperialist generals, Tilly and Wallenstein, and in 1629 Christian was forced to make terms for himself (Treaty of Lübeck). But the emperor used his victory to demand, by the Edict of Restitution, the restoration of all ecclesiastical lands secularized since 1555, and this proposed economic revolution alienated the Lutherans and destroyed general confidence in the Constitution of the empire. A fresh intervention followed. Gustavus Adolphus of Sweden invaded Germany in 1630 as the champion of European Protestantism, and also with the aim of establishing Swedish supremacy on the coasts of the Baltic. Cardinal Richelieu (q.v.) gave him French help, and, though he failed to prevent the imperial army from sacking the Protestant town of Magdeburg, he won a great victory at Breitenfeld (17th Sept., 1631). The violence of the imperial army led John George, Elector of Saxony, and leader of the Lutherans, to abandon his neutrality and join the Protestants, whose prospects seemed hopeful until Gustavus Adolphus (q.v.) was killed at Lützen (16th Nov., 1632). The struggle was continued by the Swedish statesman Oxenstjerna, and by Bernhard of Saxe-Weimar, but their chances of success were destroyed at Nördlingen (1634), and Saxony made peace with the emperor at Prague (1635).

The intervention of Gustavus Adolphus had saved Protestant Germany from the policy of the Edict of Restitution, and though the Treaty of Prague made no provision for the Calvinists, it was hoped that it might lead to a general peace. But Richelieu was determined to continue the war in order to weaken Austria and also Spain, with which the emperor was in close alliance. After the battle of Nördlingen, France became the leader of the German Protestants, and the war ceased to be a war of religion and became a conflict between the Bourbons and the Habsburgs, the Swedes continuing the struggle in order to acquire German territory. French intervention on a large scale was not at first successful, but the tide had turned against the emperor and Spain before the death of Richelieu in 1642. His policy was continued by Mazarin, and in 1644–5 France conquered the Upper Rhineland, and the great French general Turenne reduced Bavaria (1646–8). Meanwhile, negotiations for peace had been in progress. Germany was completely exhausted, and the death of the Emperor Ferdinand II (1637) had long ago removed a serious obstacle to peace. A congress met at Münster (1644), and several of the German states made separate treaties, but it was not until 1648 that the German war was concluded by the Peace of Westphalia. The German Calvinists obtained legal recognition, and it was agreed that the ecclesiastical lands should remain in the possession of those who held them in 1624. The Lower Palatinate was restored to the son of Frederick V (who had died in 1632), and Maximilian of Bavaria was given the Upper Palatinate. Sweden acquired Western Pomerania and the secularized bishoprics of Bremen and Verden, and Brandenburg, which lost Western Pomerania, received territorial compensation elsewhere. France obtained Austrian Alsace, and her right to the bishoprics of Metz, Toul, and Verdun was recognized. The Treaty of Westphalia marks the decline of the imperial ideal, for after the Thirty Years' War the empire became definitely Austrian. See *Austria-Hungary*; *Holy Roman Empire*; &c.—BIBLIOGRAPHY: S. R. Gardiner, *The Thirty Years' War*; A. Gindely, *History of the Thirty Years' War*; C. R. L. Fletcher, *Gustavus Adolphus*.

Thistle, the common name of prickly plants of the tribe Cynaraceæ, nat. ord. Compositæ. There are numerous species, most of which are inhabitants of Europe, as the musk-thistle (*Carduus nutans*), milk-thistle (*C. Mariānus*), welted thistle (*C. acanthoides*), slender-flowered thistle (*C. tenuiflōrus*), the spear thistle (*Cnicus lanceolātus*), and field thistle (*Cnicus arvensis*), a well-known plant very troublesome to the farmer. The blessed-thistle, *Carduus benedictus* of the pharmacopœias, *Cnicus benedictus* or *Cirsium benedictum* of modern botanists, is a native of the Levant, and is a laxative and tonic medicine. The cotton-thistle belongs to the genus Onopordum. The common cotton-thistle (*O. Acanthium*) attains a height of from 4 to 6 feet. It is often regarded as the Scotch thistle, but it is doubtful whether the thistle which constitutes the Scottish national badge has any existing type, though the stemless thistle (*Cnicus acaulis* or *Cirsium acaule*) is in many districts of Scotland looked on as the true Scotch thistle. The carline thistle (q.v.) belongs to the genus Carlina. Some species are cultivated in gardens for the beauty of their flowers. Thistles sow themselves readily by their winged seeds.

Thistle, Order of the, a Scottish order of knighthood, sometimes called the order of St. Andrew. It was instituted by James VII (James II of England) in 1687, when eight knights were nominated, fell into abeyance during the reign of William and Mary, and was revived by Queen Anne in 1703. The insignia of the order consist of a gold collar composed of thistles intermingled with sprigs of rue; the St. Andrew of gold enamelled, with the gown green and the surcoat purple, bearing before him the cross enamelled white, and having round the image rays of gold going out from it in the form of a glory; the mantle of green velvet bound with taffeta and tied with cords and tassels of green and gold; on the left shoulder is a representation of the star of the order; the star, consisting of a St. Andrew's cross of silver embroidery, with rays emanating between the points of the cross; in the centre upon a field of gold, a thistle of green, heightened with gold, and surrounded by a circle of green, having thereon the motto in letters of gold, *Nemo me impune lacessit*; and the badge or jewel (of gold enamelled), which has on one side the image of St. Andrew with the cross before, enamelled as above described, or cut in stone, and on the back enamelled a thistle, gold and green, the flower reddish, with the before-mentioned motto round it, the thistle on an enamelled green ground. The order consists of the sovereign and sixteen knights, besides extra knights (princes), and a dean, a secretary, the Lyon king-of-arms, and the gentleman usher of the green rod.



Order of the Thistle, Star, Collar with the St. Andrew, and Badge

Tholen, an island of the Netherlands, in the province of Zeeland, in the Scheldt estuary. Tholen (pop. 3000) is the capital. There are fishing and spinning industries.

Thomas, St., also called *Didymus*, one of the Twelve Apostles, said to have been a native of Antioch. The particulars of his life are unknown, the chief fact known regarding him being his doubts as to the living reality of Christ after the resurrection. He figures largely in the apocryphal gospels, and tradition has it that he acted as a Christian missionary in Ethiopia, Egypt, India, and even America.

Thomas, Arthur Goring, English composer, born in 1850, died in 1892. His opera *The Light of the Harem* belongs to his student days. *Esmeralda* (1883) followed with great success, and his later operas are *Nadeshda* (1885) and *The Golden Web* (1893), the latter completed by another hand. His other works include: *The Sun-Worshippers* (1881; a choral ode), *Out of the Deep* and *The Swan and the Skylark* (cantatas), orchestral and violin pieces, songs, &c.

Thomas, George Henry, American soldier, born in 1816, died in 1870. Educated at West Point, he took part in the Mexican War (1846–7); was appointed professor at West Point in 1850; recalled to active service in 1855, and employed in Texas against the Indians. When the War of Secession broke out, Thomas became brigadier-general of volunteers, and subsequently took part in the battle of Murfreesborough, while at the battle of Chickamauga, in Sept., 1863, he saved the Federal army from destruction by his stubborn resistance after the defeat of the Federal right. In the campaign of 1865 he defeated Hood, and compelled the Confederates to raise the siege of Nashville, for which he received the thanks of Congress.

Thomas à Kempis, German mystic, born at Kempen in 1380, died in 1471. His proper surname was Hamerken or Hämmerlein (Little Hammer, Latinized as Malleolus), but he was called after his native town à Kempis. At the age of twelve he entered the School of the Brothers of Common Life at Deventer, and about 1399 he took up his residence in the Augustine monastery of Mount St. Agnes at Zwolle. Ordained priest in 1414, he lived absorbed in literary and pious labours, and was greatly esteemed for his saintliness. His numerous Latin works include a chronicle of his monastery, sermons, hymns, moral treatises, and other writings. His fame, however, rests entirely upon his celebrated devotional treatise entitled *Imitatio Christi*. This work, which appeared anonymously, underwent several revisions, and is divided into four books. The *Imitatio Christi* has passed through an enormous number of editions in almost all languages, being the most widely distributed book after the Bible. The authorship has for some time been claimed for Jean Charlier de Gerson (1363–1429), chancellor of the University of Paris, but the work is now generally accepted as that of Thomas à Kempis.—Bibliography: F. R. Cruise, *Outline of the Life of Thomas à Kempis*; J. E. G. de Montmorency, *Thomas à Kempis: his Age and his Book.*

Thomas-Gilchrist Process. See *Steel.*

Thompson, Francis, English poet, was born in 1859, and died in 1907. He was originally intended for the Roman Catholic priesthood, and was sent to Ushaw College; but afterwards studied medicine with little enthusiasm at Owens College, Manchester. After several years of obscurity and great privation, owing to which he acquired the habit of opium-eating, some of his poems were published in *Merrie England* in 1888. He was induced to enter a hospital and to abandon opium. His first volume of *Poems* appeared in 1893; by far the most magnificent of these poems was *The Hound of Heaven. Sister Songs* followed in 1895, and *New Poems* in 1897. Thompson also wrote much prose, and contributed frequently to *The Athenæum. Health and Holiness* appeared in 1905, and after his death appeared a notable *Essay on Shelley.* Thompson was always an ardent Roman Catholic, and much of his work is inspired by a mystical religious fervour which makes it resemble the work of Crashaw.

Thomson, Sir Charles Wyville, British naturalist, born in 1830 in Linlithgowshire, died in 1882. Educated at the University of Edinburgh, he became professor of mineralogy and geology in Queen's College, Belfast, in 1854. In the dredging expeditions of the *Lightning* and *Porcupine* (1868–9) he took part, afterwards publishing in *The Depths of the Sea* (1869) the substance of his discoveries in regard to the fauna of the Atlantic. In 1869 he became Fellow of the Royal Society; in 1870 professor of natural history in the University of Edinburgh. In 1872 he was appointed scientific chief of the *Challenger* expedition, which was absent from England three and a half years, during which time 68,890 miles were surveyed. On his return he was knighted, and entrusted by the Government with the task of drawing up a report on the natural history specimens collected during the expedition. But he only lived to publish a preliminary account of the expedition, *The Voyage of the Challenger: the Atlantic* (*1876–8*). See *Challenger Expedition.*

Thomson, James, Scottish poet, was born in 1700 at Ednam, near Kelso, in Scotland, died in 1748. The son of the minister of Ednam parish, he was educated at Jedburgh and the University of Edinburgh, where *Winter*, the first of his poems on the seasons, was published in 1726. In 1727 he published his *Summer*, his *Poem to the Memory of Sir Isaac Newton*, and his *Britannia*, in 1728 his *Spring*, and in 1730 his *Autumn*. After travelling for some time on the Continent with the son of Sir Charles Talbot, afterwards Lord Chancellor, he was rewarded with the post of Secretary of Briefs, which he held till the death of the Chancellor (1737), when he received a pension of £100 from the Prince of Wales. Meanwhile he had brought on the stage his tragedy of *Sophonisba* (1729) and published his poem on *Liberty*, the cool reception of which greatly disappointed him. He now (1738) produced his tragedy of *Agamemnon*, and a third entitled *Edward and Eleanora.* In 1740 he composed the masque of *Alfred* in conjunction with Mallet; but which of them wrote the famous song *Rule, Britannia* is not known. In 1745 his most successful tragedy, *Tancred and Sigismunda*, was brought out and warmly applauded. The following year he produced his *Castle of Indolence*, a work in the Spenserian stanza. He left a tragedy entitled *Coriolanus*, which was acted for the benefit of his relatives. Thomson was greatly beloved for his amiability and kindness of heart. His *Seasons*, on which his fame rests, abounds in beauty of natural description. His *Castle of Indolence*, though not so popular as the *Seasons*, is still read, but his tragedies are almost forgotten. — Bibliography: Editions of works— George, Lord Lyttelton (1750); D. C. Tovey (1897); W. Bayne, *Life of James Thomson* (Famous Scots Series); Samuel Johnson, *Lives of the English Poets*; Léon Morel, *James Thomson: sa vie et ses œuvres.*

Thomson, James, physicist and engineer, born in Belfast in 1822, died in 1892. He succeeded Rankine as professor of engineering in Glasgow University in 1873, and held the chair till 1889. Some useful hydraulic devices which he invented testify to his skill and ingenuity in matters mechanical, but his most important work was in physics, and his name is most frequently mentioned now in connection with his discovery of the effect of pressure in lowering the freezing-point of water. He was a brother of Lord Kelvin.

Thomson, James, Scottish poet, born at Port-Glasgow, Scotland, in 1834, died in 1882. He was brought up at the Caledonian Orphan Asylum, both his parents having died when he was very young. He became a schoolmaster in the army, but quitted that occupation in 1862, and became clerk in a solicitor's office. In 1860 he became a contributor to *The National Reformer*, in which was published, under the signature 'B. V.', *The Dead Year*; *To our Ladies of Death*; and the poem by which he is best known, *The City of Dreadful Night* (1874). Among his other works are: *Tasso and Leonora* (1856), *The Doom of a City* (1857), *Sunday at Hampstead* (1863), *Sunday up the River* (1868), *A Voice* *from the Nile* (1881), and *Insomnia* (1882). Thomson's verse is characterized by much brilliancy and traits of graceful humour, but its prevailing tone is one of despair.—*Cf.* H. S. Salt, *Life of James Thomson.*

Thomson, John, Scottish landscape-painter, born in 1778, died in 1840. He succeeded his father as minister of the parish of Dailly, Ayrshire, in 1800, and exchanged that living for Duddingston, near Edinburgh, in 1805. Thomson early turned his attention to art, and produced a large number of landscapes, which are considered to rank him among the best painters of his native land.

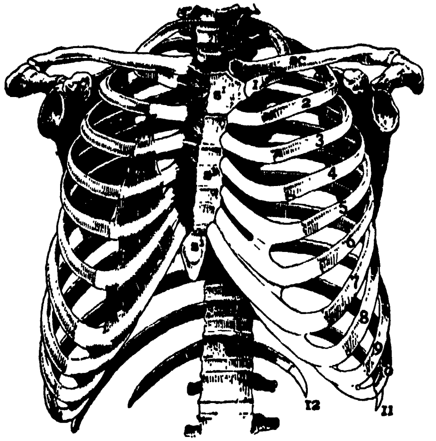
Thomson, Joseph, Scottish traveller and explorer, born at Penpont, Dumfriesshire, 1858, died in 1895. In 1882 he explored the Rovuma in East Africa, and in 1884 made an important journey through Masai Land, in eastern equatorial Africa. Among his other achievements were expeditions to the Atlas Mountains, the Rivers Niger and Benue, Zambesia, &c.

Thomson, Thomas, Scottish chemist, born at Crieff in 1773, died in 1852. He adopted the medical profession, and in 1802 published his *System of Chemistry*, containing the first detailed account of Dalton's atomic theory. In 1813 he went to London and commenced there a scientific journal, the *Annals of Philosophy*, which was afterwards merged in the *Philosophical Magazine.* The lectureship (afterwards the regius professorship) in chemistry in Glasgow University was conferred on him in 1817. Among his works are: *Attempt to establish the First Principles of Chemistry by Experiment, History of Chemistry*, and *Outlines of Mineralogy and Geology.*

Thomson, William, British prelate, born at Whitehaven 1819, died 1890. He was educated at Shrewsbury School and Queen's College, Oxford, of which he was successively Fellow, tutor, and provost. In 1858 he was chosen preacher of Lincoln's Inn, and in 1859 was appointed one of Her Majesty's chaplains in ordinary. Two years later (1861) he was raised to the episcopal bench as Bishop of Gloucester and Bristol; but before he had held the appointment twelve months he was transferred to the archbishopric of York. Dr. Thomson was the author of a number of works, including: *An Outline of the Necessary Laws of Thought*; *The Atoning Work of Christ, viewed in Relation to some Current Theories*; *Crime and its Excuses*; *Life in the Light of God's Word* (sermons); *Limits of Philosophical Inquiry*; *Design in Nature*; and a series of essays entitled *Word, Work, and Will.*

Thor, son of Odin by Jörd (the earth), the Jupiter of Teutonic mythology, the god of thunder. He was represented as a powerful man in the prime of life, with a red beard, girt with his girdle of strength, and armed with his mighty hammer *Miölnir* (the smasher). *Thursday* has its name from him. See *Northern Mythology.*

Thorax, the chest, or that cavity of the human body formed by the spine, ribs, and breast-bone, situated between the neck and the abdomen. It contains the pleura, lungs, heart, &c. The name is also applied to the corresponding portions of other mammals, to the less sharply defined cavity in the lower vertebrates, as birds, fishes, &c., and to the segments intervening between the head and abdomen in insects and other Arthropoda. In serpents and fishes the thorax is not completed below by a breast-bone. In insects three sections form the thorax: the *pro-thorax*, bearing the first pair of legs; the *meso-thorax*, bearing the second pair of legs and first pair of wings; and the *meta-thorax*, bearing the third pair of legs and the second pair of wings.



Sketch of Thorax viewed from the front left side

1–7, True ribs. 8–10, False ribs 11, 12, Floating ribs. s^1, The manubrium or first part of sternum. s^2, the middle of the sternum. s^3, Ensiform portion of sternum. On the right the anterior ligaments are shown. sc, Clavicle.

Thoreau (tho'rō), Henry David, American naturalist and author, born at Boston in 1817, died in 1862. He was educated at Harvard University, where he graduated in 1837. From that time till 1840 he was engaged as a schoolmaster. Then for several years he occupied himself in various ways, in land-surveying, carpentering, and other handicrafts, but devoting a great part of his time to study and the contemplation of nature. In 1845 he built for himself a hut in a wood near Walden Pond, Concord, Massachusetts, and there for two years lived the life of a hermit. After quitting his solitude, Thoreau pursued his father's calling of pencil-maker at Concord. Besides contributing to the *Dial* and other periodicals, he published *A Week on the Concord and Merrimac Rivers* (1849); and *Walden, or Life in the Woods* (1854). After his death appeared *Excursions in Field and Forest*, *The Maine Woods*, *Cape Cod*, and *A Yankee in Canada.* Thoreau was a friend of Emerson, and imbibed much of his spirit and method of thought.

Thorite, mineral thorium orthosilicate, crystallizing like rutile, and with a specific gravity of 5. It is sought after as a source of thorium for the incandescent-mantle trade, and is strongly radio-active. See *Monazite.*

Thorium, a rather rare metal; symbol, Th; atomic weight, 232·15. It is mainly obtained from monazite sand, and also occurs in the mineral *thorite.* Its oxide, ThO_2, is known as thoria, and together with ceria, the oxide of cerium, forms one of the essential constituents of the ordinary incandescent gas mantles. Thoria is radio-active, and a gas mantle placed on a photographic plate affects the plate and photographs itself upon it.

Thorn, a town and strong fortress of Poland, on the Vistula. It consists of an old and a new town, and has several churches, one of them containing a statue of Copernicus, who was born there. It has manufactures of machinery, soap, and a famous gingerbread. Founded by the knights of the Teutonic order in 1232, it was annexed to Poland in 1454. In 1793, at the partition of Poland, it reverted to Prussia, and was, from 1807 to 1818, part of the Grand-Duchy of Warsaw. It was given to Poland by the Treaty of Versailles, and named by the Poles Torún. Thorn is an important railway junction on the Schneidemühl-Insterburg line *via* Schönsee (for Bromberg or Bydgoszcz) and lines to Posen (q.v. see *Prussia, East*) and Alexandrowo. Pop. (1921), 39,419.

Thornaby-on-Tees, a municipal borough and market town of England, in the North Riding of Yorkshire, on the Tees. It is opposite Stockton, and was formerly known as South Stockton. Engineering establishments, iron foundries, sawmills, and flour-mills are among employments. Pop. 19,800.

Thornhill, Sir James, English painter, born in 1676, died in 1734. He was much engaged in the decoration of palaces and public buildings, in which his chief works are to be found. Among his best efforts may be mentioned the dome of St. Paul's, the saloon and refectory at Greenwich Hospital, and some rooms at Hampton Court. His forte was in the treatment of allegorical subjects.

Thornycroft, Sir William Hamo, British sculptor, born in 1850. He first exhibited at the Academy in 1871. In 1875 he gained a gold medal from the Academy for a group representing *A Warrior bearing a Wounded Youth from the Field of Battle.* His other works include: the national memorial to General Gordon in Trafalgar Square, London; *Medea*; *The Mirror*, his diploma work; *The Mower*; *Lot's Wife*; and *The Kiss.* He died in 1925.

Thorpe, Benjamin, an English scholar who greatly furthered the study of Anglo-Saxon, born 1782, died 1870. Among his numerous publications are: an English edition of Rask's *Anglo-Saxon Grammar*, *Ancient Laws and Institutes of the Anglo-Saxon Kings*, *The Gospels in Anglo-Saxon*, an edition of *Beowulf*, *The Anglo-Saxon Chronicle*, *Northern Mythology*, &c.

Thorwaldsen (tor′vȧld-sėn), Albert Bartholomew (Bertel), Danish sculptor, born at Copenhagen 19th Nov., 1770, died 24th March, 1844. At first he helped his father to cut figure-heads in the royal dockyard, then, after some years' study at the Academy of Arts, he won the privilege of studying three years abroad. In 1797 he went to Rome, and remained in Italy until 1819. In 1809 he produced his statue of *Jason.* In 1819 he came to Copenhagen, but, after a stay of three years, returned again to Rome. The Thorwaldsen Museum, opened in 1846, contains about 300 of the works of the sculptor. Thorwaldsen was eminently successful in his subjects chosen from Greek mythology, such as his *Mars*, *Mercury*, *Venus*, &c. His religious works, among which are a colossal group of *Christ and the Twelve Apostles*, *St. John Preaching in the Wilderness*, and statues of the four great prophets, display much grandeur of conception. Chief among his other works are his statues of Galileo and Copernicus, and the colossal lion near Lucerne, in memory of the Swiss Guards who fell in defence of the Tuileries. —BIBLIOGRAPHY: J. M. Thiele, *Life of Thorwaldsen*; E. Plon, *Thorwaldsen: sa vie et son œuvre*; C. A. Rosenberg, *Thorwaldsen* (Künstlermonographien, No. 16).

Thoth, an Egyptian deity identified by the Greeks with Hermes (Mercury), to whom was attributed the invention of letters, arts, and sciences. The name is equivalent in significance to the Greek Logos, and Thoth is a mythical personification of the divine intelligence. He is represented with the head of an ibis or a dog. There were forty-two sacred books under his name, which were under the guardianship of the Egyptian priests.

Thou (tŏ), Jacques Auguste de, French statesman and historian, born in 1553, died in 1617. Henry IV employed him in several important negotiations, and in 1593 made him his principal librarian. In 1595 he succeeded his uncle as Chief Justice, and during the regency of Mary de' Medici he was one of the directors-general of finance. His greatest literary labour was the composition in Latin of a voluminous history of his own times (*Historia sui Temporis*), comprising the events from 1545 to 1607, of which the first part was made public in 1604. To this work, which is remarkable for its impartiality, he subjoined interesting *Mémoires*.

Thourout (tō-rō), a town of Belgium, in the province of West Flanders. Manufactures include cloth, chicory, and leather. There is an agricultural trade. Captured by the Germans in 1914, it was retaken by Belgian troops on 16th Oct., 1918. Pop. 11,000.

Thousand Islands, a group of small islands, numbering about eighteen hundred, in the St. Lawrence immediately below Lake Ontario. They partly belong to Canada and partly to the state of New York, and have become a popular summer-resort.

Thrace[1], the south-easternmost region of Europe. The region considered here is bounded on the west by the Maritsa (Maritza) and on the north by Bulgaria, and, excepting the Chatalja, is coextensive with Turkey in Europe after the armistice of Mudania and the Conferences of Lausanne.

Physical. — Thrace comprises (1) an almost treeless Central Plateau, flanked by (2) the Istranja mountain system, and fringed by (3) coastal regions, which are low everywhere but the Dardanelles, and border the Ægean, the Sea of Marmara, and the Black Sea. Three divisions of the Istranja mountain system may be distinguished: (1) the wooded gneiss- and granite-hills of the Istranja Dagh, flanking the Central Plateau on the north, and trending south-eastwards to join the heights of the Chatalja Peninsula; (2) the extension of the Istranja Dagh south-westwards as the Tekfur Dagh, and its prolongation into Gallipoli Peninsula; and (3) the Kuru Dagh, which is separated from (2) by the valley of the Kavak Dere, a river flowing southwards into the Gulf of Saros (Xeros). The Chatalja hills (about 600 feet) extend across the Chatalja Peninsula between Derkos Geul (Lake) on the north and the Kuchuk Chekmeje lagoon (Sea of Marmara), and form an impenetrable fortified outpost of Constantinople, of gigantic size, protected in front by the Ak Dere and behind by the Kara Su, rivers that may be called natural moats. Magiada (3394 feet altitude) is the highest point of the Istranja Dagh; Pirgos (3024 feet) and Chatal Tepe (1169 feet) are highest in (2) and (3) respectively. The Tekfur and Kuru hills enclose the Central Plateau on the south, and north of them is the Yaila Dagh, culminating in Rudeli Dagh (1050 feet altitude). Between the southern mountains and the Central Plateau, however, there lies the deep, broad, flat valley of the Ergene, which drains the Plateau and flows to join the Maritsa (ancient *Hebrus*), the principal river of Thrace, some 26 miles above its embouchure. The streams of Thrace are so numerous that no small map shows them all. In the south-west corner of Thrace the climate is Mediterranean, but winters are colder; elsewhere, excepting Constantinople, the region is transitional between the Mediterranean and the Steppes, with winter rains and very cold north winds. In the Maritsa Valley (south-west) the olive is found. Constantinople, which, on account of its peculiar geographical situation, is rather warmer, forms in itself a climatic subdivision.

Production.—Thrace has been devastated by frequent wars, and is not greatly developed agriculturally. The chief crops are maize, wheat, oats, barley, and oil-seeds; cotton is grown on Gallipoli; sericulture is progressive in South-Western Thrace; the vine and viticulture are ubiquitous, but are especially noted in the Marmara and Dardanelles coast regions. Forestry has suffered from indiscriminate felling. Oak, beech, plane, birch, pine, and elm are representative of the Belgrade Forest (Chatalja Peninsula), and of the wooded slopes of the main Istranja range, behind which live-stock (cattle, sheep, and goats) are grazed. The fisheries of the Marmara yield chiefly mackerel, but also sardines, tunny, bass, and mullet (red and grey). Manufactures are of no importance. Some coal is worked at Keshan (pop. 30,000), for which place Ibrije is the port; but Keshan is connected by rail with the great Oriental trunk line that forms a link between Constantinople (see *Systems*, *Railway*, sections 6 (*h*) and 14 (*f*)) and Central Europe. Rodosto (q.v.), where there are lignite-mines, is the chief port.[1]

Towns.—Besides those places already mentioned, the chief are Adrianople, Gallipoli, Silivri, Chorlu, Lule Burgas, Hairobolu, and Malgara.

History.—From earliest historic times Thrace has been a convenient ground whereon contending kings, statesmen, and nations have submitted their differences to the arbitrament of the sword; and, as a highway out of the east into the west, it has passed under the sway of many rulers. Beginning with the Greeks, who founded a number of maritime settlements but did not attempt to explore the hinterland, *Thracia* formed, with *Europa*, *Libya*, and *Asia*, the whole of the known world, or the postulate that passed as such; but the designation was subsequently narrowed down to embrace only the region south of the *Haemus* mountain chain, and east and north-east of Macedonia. Darius crossed Thrace in 513 B.C., and it was subdued by one of his generals. Xerxes was unopposed in his march during 480 B.C., but after Salamis the Greeks regained the territory, which again fell to the Persians and Spartans after the Peloponnesian War. Philip II of Macedon later succeeded in subduing a large section. His work was continued by Alexander the Great, upon whose death Thrace was the portion allotted to Lysimachus. Ptolemy Euergetes annexed the country to Egypt (247 B.C.), and under the Ptolemies it remained for half a century. Under the Romans, Thrace was at first left entirely to native rulers, but was made a province in 46 B.C. Thracians fought for Pompey against Cæsar. Under Augustus the Thracian princes bore the same relationship to Rome as do the Indian potentates to the British Crown in modern times. On the division of the Roman Empire (A.D. 395), Thrace was attached to the eastern or Byzantine half. In A.D. 255 appeared the Goths, followed by Alaric in 395 and Attila in 447, and in 1341 the Osmanlis crossed to Europe and captured (1453) the Thracian stronghold Constantinople. Under the Romans, Thracian troops were largely employed as light infantry, and the Thracian gladiators, of whom Spartacus (q.v.) was one, were justly famous. The native Thracians were generally of exceptional military ability, and were greatly in demand as mercenaries in classical times; and the inherent weakness of their state is ascribed by Herodotus to discord and jealousy among the various clans, who could not be persuaded to combine for war, excepting for freebooting expeditions of short duration. The reign of Sitalces of the Odrysæ dynasty was the golden age of Thracian sovereignty. On his death in battle (424 B.C.) the nephew of Sitalces succeeded him as Seuthes I, whose reign marks the beginning of the decay of Odrysian power.

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[1] The spelling of geographical names in this article has been assimilated to the system of the Royal Geographical Society. Where, for any reason, such as, for example, familiar and common usage, the corresponding article in the *New Gresham Encyclopedia* does not follow the new standard, the older form is given in parenthesis.

[1] The bulk of Turkish coal comes from the Heraclea Basin in Anatolia (see *Songulduk*).

Modern History.—In 1520 Turkish power reached its zenith (see map under *Turkey*). During 1875 a great revolutionary movement began, in the course of which several new states appeared. In 1877 Russia declared war on Turkey, and the Grand Duke Nicholas took Adrianople, pushing on to San Stefano, which he made his head-quarters. By arrangement with Great Britain, however, Constantinople was not entered, and the Treaties of San Stefano and Berlin (3rd March and 13th July, 1878, respectively) concluded the campaign.

First Balkan War.—The foregoing treaties were more or less the creators of Bulgaria, Serbia, and Roumania as states. During the rise to power of the Young Turk party, Venizelos and Tsar Ferdinand of Bulgaria formed a League of Balkan States, of which Serbia, Bulgaria, Greece, and Montenegro were members (see *Balkan League*). This League declared war on Turkey (1912), and the success of its arms was overwhelming, the Turkish army making a final desperate stand on the Chatalja lines. By the Treaty of London (30th May, 1913), negotiated through the intervention of the Powers, war was nominally at an end; but it had only just begun, for the victors now began to quarrel over the spoils, and the rapacity of Bulgaria provoked a second war among the former allies.

Second Balkan War.—Serbia and Greece became allies against Bulgaria, and Roumania cast a suspicious eye upon all three, for she had a frontier grievance against Bulgaria, and Serbia was her only possible ally against that country. On 29th June, 1913, the war began, Bulgaria assuming the offensive against Serbia and Greece. Roumania then invaded Bulgaria, and reached Sofia without firing a shot, after having overrun the whole of Northern Bulgaria. Meanwhile Turkey marched into Thrace, seized Adrianople, entered Bulgaria, and then sat down to await the customary diplomatic *parlers*, which usually, on the Turkish side, are confined to *demander un bœuf pour avoir un œuf*. Eventually the Treaty of Bucharest was negotiated, and was ratified by all concerned on 25th Aug., 1913. Bulgaria received a southern egress to the Ægean, between the Mesta River on the west and the Lower Maritsa on the east, and the eastern frontier between Turkey and Bulgaria remained substantially the same under the Turko-Bulgar Treaty of Constantinople (29th Oct., 1913). See *Balkan War*.

European War.—On the outbreak of war the Turkish frontier on the north was bounded by the line of the Rezvaya River, some 30 miles north of Midia, and swung south-eastward on crossing the Tunja to enclose Adrianople, crossing the Maritsa, which it joined and followed from below Demotika to the Ægean, the unhealthy delta being allotted to Turkey. After the European War (q.v.) Turkey was dismembered, and Bulgaria was deprived of her outlet to the Ægean. The Turks were shut in by the Chatalja lines, and Constantinople had an Allied garrison, while the rest of Thrace was handed over to the Greeks. Mustafa Kemal's campaign during 1922 again made it necessary to consider some territorial readjustments, and at the Conference of Lausanne (1922–3) it was agreed to return to Turkey the whole of Eastern Thrace up to the Maritsa line, thus reverting practically to the old frontier arrangements of the Treaty of Constantinople, except that Greece lies west of the Maritsa and not Bulgaria. Adrianople is included in the Turkish territory. See *European War* (section *Turkey and the War*), and *Gallipoli.*

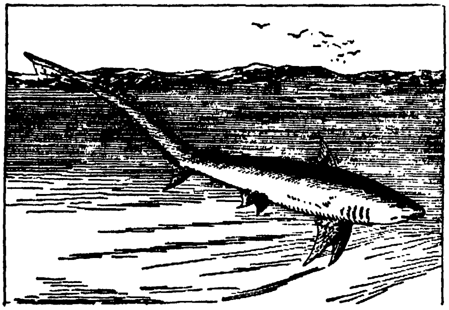
Thread, a slender cord consisting of two or more yarns, or simple spun strands, firmly united together by twisting. The twisting together of the different strands or yarns to form a thread is effected by a thread-frame or doubling and twisting machine, which accomplishes the purpose by the action of bobbins and flyers. Thread is used in some species of weaving, but its principal use is for sewing. The manufacture of sewing thread in the United Kingdom both for home use and export is very extensive. As a general rule, the thread manufactured for home use, and for export to the United States, is much superior to that made for other markets, which is of an inferior quality. The thread made for home use is commonly known as six-cord, and that for export as three-cord thread. The chief seat of the cotton thread manufacture in Scotland is Paisley, in England Manchester. Linen thread is manufactured largely in Ireland, as well as in Scotland. The fine flax lines or flax threads are used for sewing valuable articles, while the coarser flax threads are used extensively in the manufacture of nets of various kinds.

Thread-worms, the name for thread-like intestinal worms of the order Nematoda. The *Oxyuris vermicularis* occurs in great numbers in the rectum of children particularly. See *Nematelmia.*

Threatening. By the common law of England to threaten bodily hurt is a civil injury against the person, and pecuniary damages can be recovered for interruption of a man's business through fear of such threats. Any person accusing or threatening to accuse any other person of infamous or other crimes, with the view to extort gain, is guilty of felony. Similar provisions are made against sending or delivering any letter threatening any house, ship, &c., or to wound or maim cattle; and sending or delivering any threatening letter demanding any property or valuable. Any person who threatens to publish a libel with intent to extort money is guilty of a misdemeanour, and any person who maliciously sends or delivers, knowing the contents, any letter threatening to kill or murder any person is guilty of a felony. The intimidation of workmen to induce them to yield to combinations or associations is provided for by an Act of 1875, the penalty being a fine not exceeding £20, or imprisonment for a term not exceeding three months. "Peaceful picketing", however, and certain acts of interference in furtherance of trade disputes were legalized by an Act of 1906.

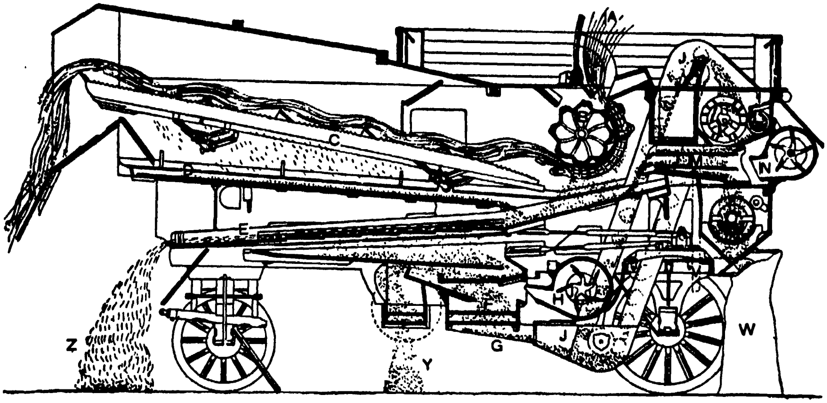
Three Rivers, a city and port of Quebec, Canada, in St. Maurice county, at the confluence of the St. Maurice and St. Lawrence; served by the Delaware & Hudson and other railways. There is a daily river-steamer service, and the concrete wharfage has depth enough alongside to accommodate the deepest vessels afloat. Paper-pulp, lumber-milling, cotton, iron-founding, steel, leathers, boots and shoes, furniture, confectionery, and food-stuffs are some of the industrial activities. Pop. (1921), 25,000.

Thresher-shark, also called the *Fox-shark,* a genus of sharks containing but one known species (*Alopecias vulpes*), with a short conical snout, and less formidable jaws than the white shark. The upper lobe of the tail fin is very elongated, being nearly equal in length to the rest of the body. It is used to crowd together the herrings, pilchards, sprats, &c., on which this species preys, by splashing the water as the thresher swims round and round the shoal. Tail included, this shark attains a length of 15 feet. It inhabits the Atlantic and the Mediterranean, and is sometimes met with on the coasts of Britain. See *Shark.*

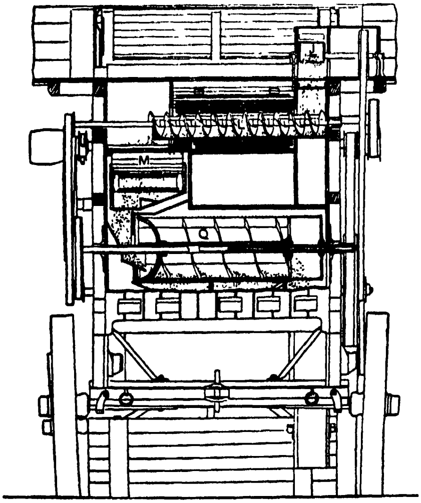


Thresher-shark

Threshing - machine, or **Thrashing - machine,** a machine for separating grain from the straw, in which the moving power is that of horses, oxen, wind, water, or steam. The threshing-machine was invented in Scotland in 1758 by Michael Stirling, a farmer in Perthshire; it was afterwards improved by Andrew Meikle, a millwright in East Lothian, about the year 1776. Since that time it has undergone various improvements. With a portable engine (a traction-engine), the machine can be moved from farm to farm, performing the threshing work of a wide district for the whole season. Power is often supplied by various types of internal-combustion engines, and tractors can also be used for this purpose.



Diagrammatic Longitudinal-section



Diagrammatic Cross-section

Description of the various Operations which take place in the 'Ruston' Single- and Double-crank Finishing Threshing-machines.

The corn is fed into the top of the machine at A, between the drum and the concave, and the threshing or beating of the grain out of the ear is effected by the *drum* B, which revolves at a high speed. The threshed straw is carried by the *shakers* C, and passed out of the machine on to the straw-board ready for stacking. Everything which has fallen through the concave or the shakers on to the collecting-board, or *top shoe* D, is carried to the inclined part of the shoe in the centre of the machine, and from there passes on to the *caving riddle* E, through which all the chaff and grain falls. The cavings, free from corn, leave the machine at the end of the shoes E, and pass out to the ground at Z, under the straw-board.

The grain and chaff below the riddles pass on to the *collecting-board*, which forms the bottom part of the shoe, through an opening, where they encounter a strong blast from the *large blower* H. By this blower the chaff is then driven out over the chaff-board and collected at Y, being at the same time thoroughly separated from weed seeds, &c.

The winnowed grain now falls through a series of *dressing riddles* F, and is here separated from the weed seeds, &c., and then carried by *spout* G to the *elevator* JJ. The elevator consists of an endless belt with cups. When working it delivers the grain to the top of the machine, where it is permitted by means of the *slide* I to pass into the *smutter* K, or into the *creeper* L. Bearded, or husky, wheat and barley is carried through the smutter; other grain which should not pass through the smutter, as, for instance, damp or smutty wheat, is conveyed by the creeper direct to the opposite side of the machine. The grain here reaches the *second dressing apparatus* and falls on the *riddles* M, passing at the same time through a blast of air from the *second blower* N.

The blower carries away the beards and any other impurities still remaining with the grain. The grain thus cleaned and winnowed for a *second time* passes into the *rotary screen* Q, which sorts the grain according to size and delivers it *through the separate outlets into the sacks* W.

If the rotary screen, however, be not required, the grain can be shut off by means of a *hinged lid*, and allowed to fall through the passage direct to the sacks.

Thrips, a genus of minute insects, the type of the order of Thysanoptera, or fringe-winged insects. They live on flowers, or plants, or under the bark of trees. *T. cerealium* is a common British species, scarcely a line in length or in extent of wing, lurking in the husks and sucking the undeveloped grains of cereals, especially wheat, to which it is most injurious.

Throat, the anterior part of the neck of an animal, in which are the œsophagus and windpipe, or the passages for the food and breath. See *Larynx*; *Œsophagus*; *Trachea*; *Diphtheria*; *Croup*; &c.

Thrombo'sis is the formation of a clot in the heart or in one of the blood-vessels. The clot may block the vessel, and, by interference with the circulation, lead to serious results.

Thrush, the name applied popularly to several perching birds. The true thrushes (Turdidæ or Merulidæ) form a family of dentirostral passerine birds, including the song-thrush or throstle, the missel-thrush, the blackbird, &c. They feed upon berries, small molluscs, worms, &c. Their habits are mostly solitary, but several species are gregarious in winter. They are celebrated on account of their powers of song; and are widely diffused, being found in all the quarters of the globe. The missel-thrush (*Turdus viscivŏrus*), the largest of the British resident species, attains a length of 11 inches, and is coloured a reddish-brown on the upper parts and yellowish-white below, the under surface being prettily marked with jetty black spots of triangular form on the throat and neck and round on the chest and belly. It begins to breed early in April, and its song, which is sweet and powerful, may be heard as early as February. The song-thrush (*Turdus musicus*) is especially distinguished by its sweet song, begun in early spring and continuing even to November or December. The colour is a brown of different shades on the upper parts, the chin being white, and the belly and under tail-coverts a greyish-white. Its average length is 9 inches. The eggs, numbering five, are blue, spotted with black. The nest is large and basin-shaped, composed of roots, mosses, &c., smoothly plastered inside with clay. The thrush family also includes the fieldfare, redwing, and ring-ouzel.

Thrush, a disease common in infants who are ill fed. (See *Aphthæ.*) The name is also applied to an abscess in the feet of horses and some other animals.

Thrust-plane, in geology, a reversed fault with a low angle of inclination to the horizon, along which rocks have been moved so as to override others of younger age. Conspicuous examples are traced in the north-west Highlands of Scotland and in the Alps.

Thucydides (thō-sid′i-dēz), the greatest of all the Greek historians, was born in Attica about 471 B.C. He was well born and rich, being the possessor of gold-mines in Thrace, and was for a time a prominent commander during the Peloponnesian War, which forms the subject of his great work. For many years he suffered exile (being accused of remissness in duty); but appears to have returned to Athens the year following the termination of the war, namely, in 403 B.C. He is said to have met a violent death, probably a year or two later, but at what exact time, and whether in Thrace or Athens, is not known. His history consists of eight books, the last of which differs from the others in containing none of the political speeches which form so striking a feature of the rest, and is also generally supposed to be inferior to them in style. Hence it has been thought by various critics to be the work of a different author, of Xenophon, of Theopompus, or of a daughter of Thucydides; but it is more probable that it is the author's own without his final revision. The history is incomplete, the eighth book stopping abruptly in the middle of the twenty-first year of the war. As an historian Thucydides was painstaking and indefatigable in collecting and sifting facts, brief and terse in narrating them. His style is full of dignity and replete with condensed meaning. He is unsurpassed in the power of analysing character and action, of tracing events to their causes, of appreciating the motives of individual agents, and of combining in their just relations all the threads of the tangled web of history.—BIBLIOGRAPHY: Editions — T. Arnold (1848–51); Bloomfield (1842–3); Classen (1862–78). Translations—Bloomfield (1829); H. Dale (Bohn Classical Library); B. Jowett. General works—G. B. Grundy, *Thucydides and the History of his Age*; W. C. Wright, *A Short History of Greek Literature*; F. M. Cornford, *Thucydides Mythistoricus.*

Thugs, the name applied to a secret and once widely spread society among the Hindus, whose occupation was to waylay, assassinate, and rob all who did not belong to their own caste. This they professed to do, partly at least, from religious motives, such actions being deemed acceptable to their goddess Kali. Between 1830 and 1835 the Government took active measures against them, and Thuggery became practically extinct by 1848.

Thule (thō′le), the name given by the ancients to the most northern country with which they were acquainted. According to Pliny the Elder, it was an island in the Northern Ocean, discovered by the navigator Pytheas, who said that it was six days' voyage to the north of Britain. From this information historians and others have postulated in succession the Orkneys, Shetlands, Iceland, and even the Norwegian coast to be the real Ultima Thule.

Thun (tön), a town of Switzerland, in the canton of Bern, at the exit of the Aar (q.v.) from the Lake of Thun. It is a Swiss military centre, and the commercial metropolis of the Bernese Oberland. It is served by the main trunk line Paris-Basel, and has lines to Burgdorf (*via* Konolfingen), Brig (for Simplon Tunnel), and (electric) Interlaken, as well as a steamer service to Lake ports. Pop. (1920), 14,162.

Thun, a lake of Switzerland, in the canton of Bern. It is 1840 feet in altitude, 10 miles long, 2 miles broad, and about 720 feet deep. At its south-eastern extremity it receives the surplus waters of the Lake of Brienz by the Aar, which again emerges from its north-western extremity.

Thunder, the violent sound which follows a flash of lightning (q.v.). Dr. Steinmetz has suggested the following as the probable average characteristics of the discharge: potential gradient at moment of discharge, 50,000 volts per foot; potential difference between discharge points in the cloud, 50,000,000 volts; current, 10,000 amperes; duration, 0·00005 second; frequency, 500,000 cycles per second; energy, 10,000 kilowatt-hour.

Thunder-fish, a species of fish of the family Siluridæ, found in the Nile, which, like the torpedo, can give an electric shock. It is the *Malapterūrus electricus* of naturalists.

Thurgau (tụr′gou), a canton of North-Eastern Switzerland; area, 381 sq. miles. It is not so mountainous as other Swiss cantons. The chief language is German. The whole canton belongs to the basin of the Rhine, and is drained by the Thur and its affluents. Large quantities of fruit are grown. Frauenfeld (pop. 8000) is the capital. It is an industrial town, and was the Swiss capital from 1712 to 1798. Pop. (canton), 135,930.

Thüringerwald (tü′ring-ėr-vȧlt), or **Thuringian Forest,** a mountain range of Central Germany. The Beerberg (3200 feet altitude) and Schneekopf are the culminating points.

Thuringia, a republic of Germany, one of the constituent states of the German Reich, formed, from an assortment of former grand-duchies and principalities, as follows:

State.	Area, Sq. M.	Pop.
Saxe-Weimar-Eisenach	1,397	270,000
Saxe-Meiningen	953	191,500
Gotha	546	434,000
Saxe-Altenburg	511	211,700
Reuss	441	212,000
Schwarzburg-Rudolstadt ..	363	99,400
Schwarzburg-Sondershausen ..	333	93,400
Republic of Thuringia	4,544	1,512,000

The capital is Weimar.

Component States.—Thuringia was formerly a convenient term used in historical geography to denominate the region lying between the Werra and Saale in Germany. By 'Thuringian States' was understood all the states tabulated above, with the addition of Saxe-Coburg; or—and it really amounts to the same thing—all those states occupying the region bounded by the Prussian provinces of Hesse-Nassau and Saxony, Bavaria, and the Kingdom of Saxony. *Saxe-Weimar-Eisenach,* a duchy comprising the detached districts of Weimar, Eisenach, and Neustadt, and twenty-four lesser enclaves embedded in neighbouring states. Weimar (the capital), Jena, Apolda, and Eisenach were the chief towns. *Saxe-Meiningen,* a duchy with its capital at Meiningen. *Saxe-Coburg-Gotha,* a duchy formed by the combination of the discrete duchies of Coburg and Gotha under one ruling house. Coburg and Gotha, the chief towns, give their names to the respective states, and the latter was capital of the united duchy. *Saxe-Altenburg,* a duchy having Altenburg as capital. *Reuss,* two principalities: (1) the Younger Branch, with Gera as capital; and (2) the Elder Branch, reigning over 122 sq. miles of territory, with Greiz as capital. *Schwarzburg-Sondershausen,* a principality with capital at Sondershausen. *Schwarzburg-Rudolstadt,* a principality with capital at Rudolstadt. All of these states were overwhelmingly Protestant (evangelical) in religion, and Protestantism is therefore the strongest religion in the republic, all other faiths being relatively insignificant.

The Union.—After the Revolution of Nov., 1918, when the ruling houses were deprived of their power, there was a decided movement towards the union of the Thuringian states. Saxe-Coburg-Gotha, however, had been held together by a purely personal bond, through the reigning house, and with the exit of the duke, Gotha and Coburg drifted apart, and resumed political power as separate entities. On the other hand, the removal of the princes of Reuss paved the way for the union of these two small states, which combined on 4th April, 1919, to form a People's State of Reuss. Meanwhile negotiations were proceeding, and on 1st May, 1920, the union of all the Thuringian states was proclaimed.[1] There is one Diet (elected by proportional representation), which elects a ministry. No President of the Republic has been provided for, and a President of the Council, a sort of chairman, is elected by the ministry. The referendum principle is in operation.

Thurles, a town of Ireland, in the county of Tipperary, on the Suir. There is a castle and a cathedral, and Thurles is the see of a Roman Catholic bishop. Pop. 5300.

Thurlow, Edward, first Baron, English lawyer and politician, born in 1732, died in 1806. Educated at Cambridge, he entered the Middle Temple, and was called to the Bar in 1754. In 1761 he became King's Counsel. Returned to Parliament for Tamworth (1768), he was made Solicitor-General (1770), Attorney-General (1771), and Lord Chancellor (1778), being raised to the peerage as Baron Thurlow. He was compelled to resign office in 1783, but he was still considered the confidential adviser of the king, and at the close of the year the Great Seal was restored to him by Pitt. He continued to hold office when in 1788 the king's illness rendered it necessary to consider the contingency of a regency. Pitt suspected Thurlow of intriguing with the Prince of Wales, and from this time an open disagreement took place between them. Pitt demanded his dismissal, to which the king at once agreed, and he was deprived of the Great Seal (June, 1792).—Cf. E. Foss, *Judges of England, with Sketches of their Lives.*

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[1] Coburg merged in the Republic of Bavaria.

Thursday (that is, 'Thor's day'), the fifth day of the week, so called from the old Teutonic god of thunder, Thor. Thursday was called by the Romans *Dies Jovis* (whence the French *jeudi*), Thor being identified with Jupiter. The German name Donnerstag is of similar origin; and *Thor*, *Donner* are equivalent to English *thunder*.

Thursday Island, an island of Queensland, in Normanby Sound, Torres Straits. It is a Government station, and the harbour — Port Kennedy—is one of the finest in this quarter. It is in the direct track of all vessels reaching Australia by Torres Straits, and is the centre of a large and important pearl and bêche-de-mer fishery.

Thurso, a seaport-burgh of Scotland, in the county of Caithness, on the Bay of Thurso. The chief trade is grain, cattle, agricultural produce, and paving-stones. Pop. (1921), 3000.

Thyestes (thī-es′tēz), in Greek mythology, son of Pelops and Hippodamia, and grandson of Tantalus. He seduced the wife of his brother Atreus, who, in revenge, served up to him the body of his own son at a feast. See *Atreus*.

Thyl′acine (*Thylacīnus cynocephălus*), a carnivorous marsupial mammal inhabiting Tasmania, but now approaching extinction. It is known as the Tasmanian wolf. In size it is generally about 4 feet in total length, though some specimens attain a much greater size. It is nocturnal in its habits, of a fierce disposition, and very destructive to sheep and other animals. It has a long and somewhat dog-like muzzle, and a long tapering tail; the fur is greyish-brown with a series of bold transverse stripes, nearly black in colour, beginning behind the shoulders and ending at the tail.

Thyme (tīm; *Thymus vulgăris*), a small plant of the nat. ord. Labiatæ, a native of the south of Europe, and frequently cultivated in gardens. It has a strong aromatic odour, and yields an essential oil, which is used for flavouring purposes. The fragrant wild thyme of the British uplands and hills is the *Thymus Serpyllum* of botanists. Both species afford good bee-pasture.

Thymelea′ceæ, the Daphne family, an order of apetalous dicotyledons, consisting of shrubs or small trees, rarely herbs, with non-articulated, sometimes spiny branches, with tenacious bark. The leaves are alternate and opposite, and the flowers spiked and terminal. The fruit is nut-like or drupaceous. The species are not common in Europe; they are found chiefly in the cooler parts of India and South America, at the Cape of Good Hope, and in Australia. See *Daphne*; *Lace-bark Tree.*

Thymol, $C_{10}H_{14}O$, is a crystalline substance obtained from the oil of thyme and other plants. The crystals, which are colourless and have the odour of thyme, are very insoluble in water. At one time it was used in medicine as an antiseptic lotion and gargle, and given as an intestinal antiseptic, but now it is only used as an anthelmintic in hook-worm disease (see *Ankylostomiasis*). For this purpose it is usually administered in capsules.

Thymus Gland, a ductless glandular organ situated in the middle line of the body. It reaches its greatest relative size about the time of birth, and continues to grow until puberty, when it begins to decrease in size. It is covered in front by the breast-bone, and lies on the front and sides of the windpipe. Its secretion is believed to co-operate with that of other glands in stimulating growth, and to exercise an inhibitory influence upon the central nervous system.

Thyroid Gland, a ductless structure in man which covers the anterior and inferior part of the larynx and the first rings of the windpipe. It is of a reddish colour, and is more developed in women than in men. It may become abnormally enlarged, as in goitre, or diseased, as in myxœdema. Its secretion exercises a profound influence upon the activity of certain other glands and the sympathetic nervous system.

Thysanu′ra ('fringe-tailed'), a sub-order of apterous insects that undergo no metamorphosis, and possess two or three slender hairy processes projecting from the tip of the tail. The silver fish (*Lepisma saccharina*) is found in brown sugar, and another common species (*Campodea staphylinus*) abounds in decaying wood, gardens, and fields.

Tia′ra (Gr. *tiara*), originally the cap of the Persian kings. The tiara of the Pope is a high cap, encircled by three coronets with an orb and cross of gold at the top. Nicholas I (858–67) was the first to unite the princely crown with the tiara. The second crown was added before the time of Innocent III. Urban V (1362–70) added the third crown. The tiara is a symbol of temporal power; at ceremonies of a purely spiritual character the Pope wears whichever of his four mitres is most suitable for the occasion.

Ti′ber (It. *Tevĕre*, ancient **Tibĕris**), a river of Italy, rising in the Apennines, in Tuscany, and, after a course of about 240 miles, falling into the Mediterranean. It traverses the city of Rome, forming the island anciently called Insula Tiberina. About 90 miles of its course are navigable for small vessels; those of about 140 tons burden reach Rome. It is subject to floods, and carries down quantities of yellowish mud, hence its designation ‘ the Yellow Tiber ’.

Tiberius, in full, Tiberius Claudius Nero Cæsar, a Roman emperor, born 42 B.C., died A.D. 37. He was the son of Tiberius Claudius, of the ancient Claudian family, and of Livia Drusilla, afterwards the wife of the Emperor Augustus. Tiberius became consul in his twenty-eighth year, and was subsequently adopted by Augustus as his heir. In A.D. 14 he succeeded to the throne without opposition. Dangerous mutinies broke out shortly afterwards in the armies posted in Pannonia and on the Rhine, but they were suppressed by the exertions of Germanicus and Drusus. The conduct of Tiberius as a ruler was distinguished by an extraordinary mixture of tyranny with occasional wisdom and good sense. Tacitus records the events of the reign, including the suspicious death of Germanicus; the detestable administration of Sejanus; the poisoning by that minister of Drusus, the emperor's son; and the infamous and dissolute retirement of Tiberius (A.D. 27) to the Isle of Capreæ, in the Bay of Naples, never to return to Rome. The death of Livia in A.D. 29 removed the only restraint upon his actions, and the destruction of the widow and family of Germanicus followed. Sejanus, aspiring to the throne, fell a victim to his ambition in the year 31; and many innocent persons were destroyed owing to the suspicion and cruelty of Tiberius, which now exceeded all limits.—BIBLIOGRAPHY: Sabine Baring-Gould, *The Tragedy of the Cæsars*; J. C. Tarver, *Tiberius the Tyrant*; C. Merivale, *History of the Romans under the Empire*.

Tibet′, or **Thibet′**, a country occupying the south portion of the great plateau of Central Asia. It has an area of 463,200 sq. miles. Its plains average above 10,000 feet in height, and many of its mountain massifs have twice that altitude. In Tibet nearly all the great rivers of South and East Asia take their rise (Indus, Brahmaputra, Hoang-ho, Yang-tse-kiang, &c.), and there are numerous salt and fresh-water lakes, situated from 13,800 to 15,000 feet above the sea-level. The climate generally is characterized by the excessive dryness of the atmosphere and the severity of the winter. From October to March vegetation is almost wholly dried up, and the cold is intense. The yak exists both wild and domesticated. It supplies food, clothing, means of transport, and fuel (the dung being burned as such). Other animals include the musk-deer, the Kashmir goat, wild sheep, wild horses, and fat-tailed sheep. Wheat, barley, peas, and beans have been noticed by travellers; maize, radishes, apricots, and walnuts are other (probable) crops. Timber includes pine and silver fir in the Chumbi Valley. The lake-river fisheries are prominent. Minerals include gold (the most important), silver, lead, copper, iron, mercury, borax, and salt. Woollen cloth, pottery, and rugs from Gyantse are the chief manufactures. Tibet does a good trade with China, giving gold-dust, incense, wool, &c., for tea, silks, and other produce. There is some trade with India; Rampur, Diwangiri, and Udalgiri (Assam) holding annual fairs for Tibetan goods, while for goods reaching India via the Chumbi Valley, Darjeeling and Kalimpong are the chief centres. Kuti (Nilam-Jong), on the Nepálese frontier, is also notable. The capital is Lhasa (q.v.). The religion is Lamaistic Buddhism (see *Lamaism*). The exact population is doubtful, but may be guessed at 3,000,000. The language belongs to the Tibeto-Burman branch of the Indo-Chinese group, and is properly monosyllabic and uninflected. It was first reduced to writing in the seventh century, when a syllabic alphabet based on the Sanskrit was imported from India. Tibet was governed by its own princes till early in the eighteenth century; since 1720 it has been a dependency of China. Owing to the refusal of the Tibetans to carry out treaty agreements, a military mission from India forced its way to Lhasa in 1904, and obtained a convention providing for the opening of trade marts and better relations—political and other—in future. Subsequent conventions were concluded in 1906 and 1907, and in 1912 the Chinese were expelled, and, after much wrangling, the Tripartite Convention of Simla (1914) provided for the division of Tibet into Outer and Inner regions, the former becoming autonomous but under British protection.

Tibul′lus, Albius, Latin elegiac poet, was born about 54 B.C., and died about 19 B.C. Very little is known about his life, and even his gentile name is uncertain. It would seem that he had inherited a large estate, most of which was confiscated in 41 B.C. His patron was M. Valerius Messalla Corvinus, whom he possibly accompanied to Gaul in 30 B.C. Two years later he started to go with Messalla to the East, but, owing to illness, remained at Corcyra. He probably spent much of his time on his country estate. The literary circle of Messalla was only slightly less brilliant than that of Mæcenas, and Tibullus was the most distinguished member of the circle. His untimely death was mourned by Ovid and Domitius Marsus.

The genuine works of Tibullus consist of two books of elegiac poems. Most of the poems which form the first book are addressed to his mistress Delia (Plania was her real name), a grass-widow whose husband was absent on military service in Cilicia. In the second book the poet addresses another mistress, with the ominous name of

Nemesis. Tibullus was a man of a gentle and retiring disposition, a valetudinarian, and something of a conscientious objector to the strenuous life. His poems are valuable, not for the account they give of his somewhat sentimental love-affairs, but for their descriptions of country life, and for that finish and gracefulness that made Quintilian place their author at the head of Latin elegists. There is little or no Alexandrian learning in Tibullus, who is always simple in his thoughts, clear in his language, and smooth in his metre. The third book of 'Tibullus' (sometimes erroneously divided and called the third and fourth books) is a collection of poems by different members of the circle of Messalla, a collection not unfittingly appended to the scanty works of the greatest member of that circle. Some of these are by Lygdamus, a cultured freedman and a foreigner; others are by Sulpicia, usually considered to have been Messalla's niece. Their poems are good, though greatly inferior to those of Tibullus; but the *Panegyric on Messalla* is one of the worst pieces of rubbish that antiquity has handed down.—Cf. W. Y. Sellar, *Horace and the Elegiac Poets.*

Tic Douloureux (dö'lö-rè), a painful affection of a facial nerve, a species of neuralgia. It is characterized by acute pain, attended with convulsive twitchings of the muscles, and continuing from a few minutes to several hours. It occurs on one side of the face, and may be caused by a diseased tooth, by inflammation in the ear passage, by exposure to cold, by dyspepsia, &c. The removal of the cause is the natural remedy; and warm applications, the employment of electric currents over the nerve, and morphia administered subcutaneously are sometimes effective.

Tichborne Case, a *cause célèbre* in English law, a classic example of 'the law's delays' and of the facility with which many persons can be deceived. Roger Charles Tichborne (1829–54) was a member of the wealthy Roman Catholic family of Tichborne, which had valuable property in Hampshire. The baronetcy in the family dates from 1621. In 1853 Roger went a trip to South America. He sailed from Rio de Janeiro in 1854 on the *Bella*, which was lost at sea with all hands. His will was proved, and no one disbelieved in his death except his mother, a French woman of neurotic temperament. In answer to her advertisements, a person appeared in 1866 claiming to be Sir Roger Tichborne (the title would have been Roger's since 1862 if he had been alive). Roger Tichborne had been slim, with sharp features and straight black hair; the 'claimant' was a mountain of flesh (he weighed 24 stone) and had wavy light-brown hair. Roger had been partly brought up in France, and spoke French like a native; his English, while not beyond reproach, was that of a public school boy and cavalry officer; the claimant was entirely unacquainted with French, and his English was that of an illiterate man. In spite of these and many other discrepancies, the claimant had innumerable enthusiastic not to say fanatical supporters. The first trial (1872) lasted 103 days; at the end of it the claimant's counsel elected to be non-suited. The claimant was put on trial for perjury, and after a trial lasting 188 days he was found guilty and sentenced to fourteen years' penal servitude. It was proved that his real name was Arthur Orton, and that he was a native of Wapping. Orton died in 1898, having in 1895 admitted his identity. The trial cost the Tichborne family £90,000.—Cf. J. B. Atlay, *The Tichborne Case.*

Ticino (ti-chē'nō; Ger. and Fr. *Tessin*), a river of Switzerland and North Italy, rising in Mount St. Gothard, and after a course of about 120 miles joining the Po on the left. It traverses Lake Maggiore and separates Piedmont from Lombardy.

Ticino (Ger. and Fr. *Tessin*), a canton of Southern Switzerland; area, 1088 sq. miles. The northern and greater part of the canton is mountainous, the Splügen, St. Bernardin, and Mount St. Gothard forming its northern boundary. The chief river is the Ticino, and Lake Maggiore is partly within the canton. Production comprises cattle-raising and dairying in the north, and viticulture, oil, and cereals in the south. The chief towns are Bellinzona (the capital), Locarno, and Lugano. Pop. (1920), 152,256 (mainly Italian-speaking Roman Catholics).

Tickell, Thomas, English man of letters, born in 1686, died in 1740. His success in literature and in life was mainly due to Addison, who procured for him in 1717 an Under-Secretaryship of State. In 1725 he was appointed secretary to the Lords Justices of Ireland, a post he held till his death. His chief works are: *Prospect of Peace*, a ballad entitled *Colin and Lucy*, and a fine elegy on the death of Addison.

Ticks, the largest members of the Acarida or order of mites, class Arachnida. They are parasitic animals, possessing oval or rounded bodies, and a piercing and sucking proboscis, by which they attach themselves to dogs, sheep, oxen, and other mammals. Birds and reptiles are also annoyed by the attacks of certain species. The common sheep-tick (q.v.) is a familiar example. Some ticks spread the germs of diseases caused by protozoan parasites, e.g. Texas fever of cattle, also known as 'red-water'.

Ticondero'ga, a village and township of Essex county, New York, United States. It stands on the stream connecting Lakes George and Champlain, and figured prominently during the colonial and revolutionary period, having a fortress built by the French in 1755.

Ticul, a ruined Maya city of Yucatan, Mexico, 31 miles south of Mérida on the railway Mérida-Peto (145 miles).

Tides, the periodical rising and falling of the waters of the ocean. The tides are said to *flow* and *ebb*, the maximum height being attained at *high water*, the minimum at *low water*. The words *flow* and *ebb* are also applied to the stream or current which in the shallower seas is a noticeable accompaniment of the variation of level. The tides are caused by the attractions of the moon and sun. Generally speaking, there are two high waters and two low waters in the lunar day of 24 hours 50 minutes, so that each day the high waters are about 50 minutes later; but this interval is variable, being shorter about new and full moon, and longer about the quadratures. Although the sun attracts the earth, and also the sea, with enormously greater force than does the moon, the latter body has a tide-producing power rather more than twice as great as the sun's. This is because the effect depends on the *difference* of attraction on the earth and the sea, and, on account of the moon's proximity, the earth's radius is a much larger fraction of the moon's distance than it is of the sun's. The varying depths of the ocean, and its interruption by the large and irregular continental masses, cause great complications in the tides, and no simple theory gives anything like a complete explanation of them. What is known as the *equilibrium theory*, however, gives a view of the subject comprising the broad features of the case, though requiring much modification when applied to the actual terrestrial conditions. The moon attracts the water on the side next to it more strongly than it does the earth as a whole, or we may say more strongly than it attracts the earth at its centre. The waters, therefore, tend to be heaped up here, producing a high tide. The moon attracts the water on the distant side less strongly than it attracts at the earth's centre. This difference operates as a force tending, as in the former case, to urge the water away from the earth's centre. Therefore here also the waters tend to be heaped up, as a high tide. On a circle all round the earth, 90° from these places, there will tend to be low tide. The earth rotates on its axis in 23 hours 56 minutes, but as the moon is moving round the earth the same way, it takes any particular meridian about 24 hours 50 minutes to perform a revolution relatively to the moon; hence the two high and two low tides in that interval.

At either new or full moon, the sun, earth, and moon are situated in one straight line. The sun's and moon's tide-producing forces are therefore combined, and we have the highest or *spring tides*. At the moon's first and last quarters, that is, at half moon, the sun is acting at right angles to, and thus opposing, the moon's tidal action, and we have the lowest or *neap tides*, which represent the effect of the moon minus that of the sun. Every fortnight there are therefore spring tides, and at the intermediate times neap tides. Figs. 1 and 2 show diagrammatically spring tides at new and full moon respectively; fig. 3 neap tides at quadrature. S and M indicate the sun's and moon's positions in respect of direction, but the relative distances and sizes of these bodies are necessarily disregarded.

In strict accordance with the theory outlined above, high water at any place would occur when the moon was on the meridian, or twelve hours from it. There would thus be high water *at noon* on the day of new or full moon. In actual fact, it may be at any time whatever on these days, but the time is approximately constant for one place. The interval from noon at which high water occurs at a place on the day of new or full moon is called the *establishment of the port*.

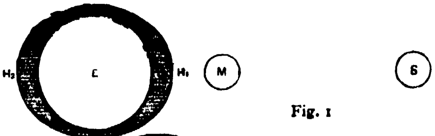

Fig. 1

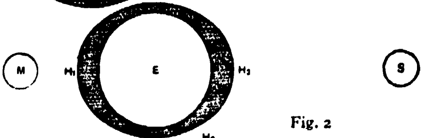

Fig. 2

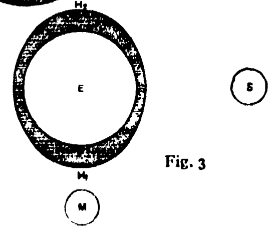

Fig. 3

The question which now naturally arises is, 'if the water tends to pile up opposite these two bodies (and at the antipodal points), and the moon's influence is twice as great as the sun's, why is it not everywhere high water approximately when the moon crosses the meridian at the given place?' There are two principal reasons why this is not the case. The first is a fundamental one, and is in accordance with the theory of forced oscillations. The tidal wave set up by an external body, say the moon, is compelled to travel round the encircling ocean at the same rate as the moon herself; it is, in fact, a forced oscillation. The vital problem which the mathematician has to solve is the speed with which this wave would continue to travel round the earth if the tide-generating forces were suddenly removed. He finds that in our particular case it would travel much more slowly than the forced wave, and theory then indicates that the crest of the forced wave lags so much behind the moon that it is actually reversed in position, that is to say, there is actually low water immediately under the moon, and high water at places 90° away from there. The latter state of affairs is further modified by friction, since water, though very mobile, does offer frictional resistance to relative movements within itself. The second reason is that the ocean, instead of being continuous over the face of the earth, is split up by great continents, so that the only region of the earth where the tidal wave has a free passage round it is the Southern Ocean. Wherever the ocean is restricted into more or less closed areas, be they even so large as the Atlantic Ocean, the tide-generating forces have far less scope. In the Mediterranean Sea the true tides are scarcely perceptible, and such as occur are much masked by secondary oscillations resulting from causes other than the lunar and solar action. But that true tides occur, even in very small bodies of water, is beyond doubt; and Professor Michelson of the United States has succeeded, by exceedingly delicate methods, in measuring the tides in a closed pipe 500 feet long. The result of the interference of land masses is that nearly all the observed tides at the world's principal ports are offshoots of the main tidal wave in the Southern Ocean. Especially is this the case for the whole of the Atlantic and Northern European coasts. The tides which proceed northwards up the Atlantic Ocean are 'free' waves like the rollers visible on a windy day, though many hundreds of miles long from crest to crest. The varying depth of the ocean through which they pass, and the irregular outline of the coasts bounding them, modify them profoundly.

The tidal waves travel with great speed for thousands of miles, and carry their influences into the more landlocked seas, inlets, firths, and river-mouths, where their speed is greatly reduced, but their height increased. There are several tidal waves traversing the earth simultaneously, each later one being some 12½ hours younger than the preceding. Before they have penetrated to the most distant recesses, they are three or four days old. It will thus be evident why high water may occur at different places at any hour in relation to the moon's position. The greatest tidal wave originates in the Pacific, near the South American coast, travels across that ocean, unites with a lesser wave born in the Indian Ocean, rounds the Cape, joins an Atlantic wave, and proceeds north. Another part of the Pacific wave enters the Atlantic via Cape Horn. The tides which reach British coasts are from one and a half to two and a half days old at different ports; hence the spring tides are a day or two after new and full moon. The Straits of Dover being so narrow as very greatly to obstruct tidal passage, our eastern coasts receive their tides round the north of Scotland. At certain places, as, for example, near the Straits of Dover, two sets of tidal waves, which have come by different routes, meet. If the two sets differ in phase by about six hours, the result is that they practically counteract each other and maintain a constant water-level.

To show the passage of the tide waves over the oceans of the earth, *co-tidal charts*, giving the positions of the crests of the waves at successive intervals of one hour, have been constructed, but the correct positions are still very uncertain for some regions.

The tides perform their oscillations so ceaselessly and with such apparent regularity that it is not to be wondered at that attempts have been made from early times to predict the height of the water at given places for long periods ahead, a prediction which, if successful, offers immense advantages to navigators. Until Lord Kelvin developed the so-called *harmonic analysis* of the tides, such methods of prediction as existed were based upon the examination of long series of tidal records with a view to the detection of peculiarities in them which could be correlated with the simpler elements of the moon's and sun's movements. In many cases a secret was made of the more successful methods. Harmonic analysis, a powerful weapon in this and other fields, seeks to disentangle from an irregularly periodic phenomenon the various harmonic oscillations, some short and some long, which are known from theory to be the probable cause of the complexity of the phenomenon. The motions of the moon and sun relative to the earth have been studied to such good purpose by astronomers that it is possible to calculate mathematically a number of periodicities in the 'tide-generating potential'. A search for these same periodicities in the recorded tides of any given place is then made, and the result is invariably to reduce the records to something like order, although to this day tidal analysis and prediction are susceptible of great improvement and are receiving the intensive study which they deserve. At Liverpool, attached to the university, is the Tidal Institute, which carries on this work and publishes an annual report on its progress. Although the tides at many places of observation are 'free' oscillations in the sense that they have travelled over vast distances from the regions in which they received their main generating impulses, yet it is, in theory, impossible for any given periodicity impressed on them there to be damped out. The relative intensities of these component oscillations are greatly modified as the tidal wave passes through areas of water of the most varied depth, breadth, and outline, and apparent new short periodicities are the result of its passage into the shallow waters of the immediate coastal or estuarine areas. The same influences cause the ranges of the tides to differ greatly from place to place in landlocked seas. At Cherbourg the spring tide range is 20·7 feet, while on the Dorset coast opposite it is little more than 6 feet. Between Wexford and the waters of the Bristol Channel there is a still greater difference.

The height of the water at a given time and place, besides being subject to the regular oscillations described above, is influenced by atmospheric pressure and by winds, being depressed when the barometer rises, and vice versa. The wind effect may on occasion assume serious proportions, as when a disastrous coastal flood is caused by a gale.—BIBLIOGRAPHY: Sir G. H. Darwin, *The Tides and Kindred Phenomena in the Solar System*; H. D. Warburg, *Tides and Tidal Streams*; The Tidal Institute, Liverpool University, *Annual Reports*; W. H. Wheeler, *A Practical Manual of Tides and Waves*; H. Lamb, *Hydrodynamics*.

Tieck (tēk), Johann Ludwig, German poet of the romantic school, born 1773, died 1853. Educated at Halle, Göttingen, and Erlangen, he began his literary work by the writing of tales and romances, e.g. *Abdallah*; the novel *William Lovell* (three vols.); *Peter Lebrecht: a History without Adventures*; and *Volksmärchen von Peter Lebrecht*. At Jena, in 1799–1800, he entered on friendly relations with the Schlegels, Novalis, Brentano, and others, and through this association arose what has been denominated as 'the Romantic School of Germany'. In 1799 he published *Romantische Dichtungen* (two vols.), and (1804) his comedy *Kaiser Octavianus*. His *Phantasus* (three vols. 1812–1817) gave the first sign of his having freed himself from the mysticism and extravagance of his earlier works. In 1817 he visited England, where he collected material for his *Shakespeare*. His *Collected Novels* (twelve vols., 1853), raised him to the front rank of contemporary literature. They include: *Dichterleben* (A Poet's Life—Shakespeare); *Der Tod des Dichters* (The Poet's Death—Camoens); *The Witches' Sabbath*; and *Aufruhr in den Cevennen* (Revolt in the Cevennes), an incomplete work. In 1826 he published his *Dramaturgische Blätter*. His study of Shakespeare resulted in *Shakespeares Vorschule*, and the continuation of the German translation of Shakespeare commenced by Schlegel. His last story of importance was *Vittoria Accorombona* (1840).—Cf. Carlyle, *Essay on Tieck*.

Tiel, a city of Holland, in the province of Gelderland, on the Waal and the Elft-Dodrecht Railway. Farm tools, tobaccos, and salt are made, and there is a fruit-shipping trade. Pop. 11,500.

Tientsin′, a town of Chihli Province, North China, the river-port of Peking, with which it communicates by the Pei-ho River. This river is only navigable by native craft, and large vessels anchor outside its mouth, in the Taku roadstead. In winter (December to April) the river is ice-bound. There is railway communication with Peking, Manchuria, &c. There is a large trade in European goods, Tientsin being one of the treaty ports. Imports include cottons, sugar, hardware, opium, &c.; exports, wool, cotton, camel's hair, &c.

The Taku forts were taken by the British and French in 1860, and Tientsin opened to foreign trade. During the Boxer Rising (1900) the city suffered greatly, and was occupied by European troops. Pop. 838,680.

Tier′ra del Fue′go, an archipelago occupying the southern extremity of South America, separated from the mainland by the Strait of Magellan. It consists of one large island (Tierra del Fuego) and several smaller, with a total area of about 32,000 sq. miles, and is divided between Argentina and Chile, the respective capitals being Punta Arenas and Ushuaia. The whole region is mountainous, but considerable areas are suited for pasturage if not for tillage, and large sheep-farms are common. The climate is moist and chilly. The natives (about 1000 only) are fast nearing extinction. Tierra del Fuego was discovered by Magellan in 1520, and received its name (Land of Fire) from the fires he saw on its coast at night.

Tiers-état. See *States-General*.

Tiflis, the capital of the Caucasian Republic of Georgia, on the Kur. Manufactures include cotton and silk, leather, and soap. The artisans of Tiflis are celebrated as silversmiths, gunsmiths, and sword-makers. The town is served by the Transcaucasian Railway, and the foreign trade of Transcaucasia with Asia is mostly carried on from Tiflis. Pop. 350,000.

Tiflis, a former government of Transcaucasia, Russia, now a province of Georgia. It is mountainous, and belongs entirely to the basin of the Kur (q.v.), the soil in the upper valley of which is of extraordinary richness, but the Steppe region in the lower reaches is dry and requires irrigation. Agriculture (wheat, maize, cotton, &c.) and stock-raising are progressive; copper (in the Lialvar Mountains), Glauber's salt, lead (Upper Kur Valley), antimony, and pyrites for sulphur are among minerals worked. About 1½ million acres of virgin forest await exploitation. Area, 15,000 sq. miles; pop. 1,473,000.

Tiger (*Felis tigris*), a well-known carnivorous mammal, possessing, in common with the lion, leopard, &c., five toes on the front feet and four on the hinder feet, all the toes being furnished with strong retractile claws. The tiger is about the height of the lion, but the body is longer and the head rounder. It is of a bright fawn colour above, a pure white below, irregularly crossed with black stripes. The tiger attains its full development in India, the name of 'Bengal tiger' being generally used as synonymous with those specimens which appear as the typical and most powerful representatives of the species, and ranges north into Manchuria, where it is represented by a thick-furred variety. The tiger also occurs in Java and Sumatra. In habits it is far more active and agile than the lion, and exhibits a large amount of fierce cunning. It generally selects the neighbourhood of water-courses as its habitat, and springs upon the animals that approach to drink. 'Man-eaters' are tigers which have acquired a special liking for human prey. The natives destroy tigers by traps, pits, poisoned arrows, and other means.

Tiger-beetle (*Cicindēla campestris*), a species of beetles which is swift and active in its movements, and preys upon other insects. The larva is equally rapacious.

Tiger-cat, a name of not very definite signification, sometimes given to some of those animals of the family Felidæ which are of middling size, and resemble the tiger in their form or markings, such as the chati, the margay, the ocelot, the serval, &c. (q.v.).

Tiger-flower (*Tigridia pavonia*), a Mexican bulbous plant of the nat. ord. Iridaceæ, frequently cultivated in gardens on account of the magnificence of its flowers. The stem is about 1 foot in height, with sword-shaped leaves. The flowers are large, of a singular form, and very evanescent. The petals are of a fine orange-red towards the extremity; whitish or yellowish and beautifully spotted at the base.

Tiger-lily (*Lilium tigrīnum*), a native of China, common in English gardens, having scarlet flowers turned downward, the perianth being reflexed. It is remarkable for having axillary buds on the stem. The bulbs are eaten in China and Japan.

Tiger-moth (*Arctia caja*), a genus of lepidopterous insects, the caterpillars of which are well known under the popular name of 'woolly bears'. The moth is coloured red and brown. The larvæ feed on dead nettles. See *Moth.*

Tigris, a river of Mesopotamia (Iraq), formed by the union of several streams near Diarbekr (East Kurdistan). It passes Diarbekr, Mosul, and Bagdad, and joins the Euphrates (q.v.) after a course of 1100 miles.

Til, or **Til-seed**, the seed of the *Sesămum indicum* (see *Sesamum*), also of *Guizotia oleifera*, a small plant belonging to the Compositæ, extensively cultivated in parts of India for the bland oil obtained from the seed.

Tilburg, a town and railway junction of the Netherlands, in the province of North Brabant. It has woollen factories, calico-printing, and other industries. Pop. (1920), 62,808.

Tilbury, an urban district of Essex, England, on the north bank of the Thames.

Tiles. See *Encaustic Tiles*; *Drainage.*

Tilia′ceæ, the lime tree family, a natural order of polypetalous dicotyledonous plants, consisting chiefly of trees or shrubs, with simple, toothed, alternate leaves, furnished with stipules. The species are generally diffused throughout the tropical and temperate parts of the globe. They have all a mucilaginous wholesome juice, and are remarkable for the toughness of the fibres of their inner bark, which is used for various economical purposes under the name of *bast.* Among the most important genera are Tilia and Corchorus, the former containing the common lime, the latter jute.

Till, a name in Scotland for unstratified stony boulder-clays, and now extended by geologists to any similar superficial or drift deposit.

Tilland′sia, a genus of epiphytes, belonging to the nat. ord. Bromeliaceæ, natives of tropical America. *T. amœna* and *T. splendens* are cultivated in hot-houses on account of the singular variety and splendour of the colours of their spathes and flower-spikes. *T. usneoides* is a native of the Southern United States, where it hangs in festoons from trees.

Tiller. See *Steering Gear.*

Tilletia. See *Bunt*; *Ustilagineæ.*

Tillicoultry (til-i-kō′tri), a manufacturing town and police burgh of Clackmannanshire, Scotland, on the Devon. The manufacture of shawls, plaids, tartans, and tweeds, &c., is largely carried on. Pop. 3100.

Tillotson, John, English prelate, born in 1630, died in 1694. In 1647 he became a student of Clare Hall, Cambridge, and he was elected a Fellow in 1651. He was a Presbyterian preacher until 1662, when he submitted to the Act of Uniformity, and was chosen preacher to the society of Lincoln's Inn, and lecturer at St. Lawrence, Jewry, in 1664. After becoming a D.D. in 1666, he was made king's chaplain, and presented to a prebend of Canterbury. He was subsequently appointed Dean of Canterbury, and in 1689 he became Dean of St. Paul's. During the suspension of Archbishop Sancroft, Tillotson exercised the archiepiscopal jurisdiction, and in 1691 reluctantly accepted the archbishopric. His liberal views rendered him obnoxious to the advocates of orthodoxy, and he was assailed with great animosity after his acceptance of the primacy. Tillotson's sermons were at one time very popular.

Tilly, Johann Tserclaes, Count von, German soldier, born about 1559 at Tilly, in Walloon Brabant, died 30th April, 1632. After being educated by the Jesuits, he served successively in the Spanish, Austrian, and Bavarian armies. On the outbreak of the Thirty Years' War (q.v.) he led the army destined to crush the Protestants in Bohemia. He defeated them at the White Mountain (Nov., 1620), and in 1622 conquered the Palatinate, defeating several Protestant commanders. On 27th Aug., 1626, he defeated Christian IV of Denmark in Brunswick, and compelled him to return to his own country. In 1630 Tilly succeeded Wallenstein as generalissimo of the imperial troops. His most celebrated exploit is the sack of Magdeburg, 20th May, 1631. Gustavus Adolphus met him at Breitenfeld, near Leipzig (17th Sept., 1631), when Tilly was beaten, and was himself wounded. In a subsequent engagement with the Swedes on the Lech (15th April, 1632) a cannon-ball shattered his thigh, and caused his death.

Tilsit, a town of East Prussia, on the Memel. Manufactures include: iron castings, machinery, paper, cloth, soap, oils, leather, and cheese. Pop. 40,000. The town is celebrated for the peace concluded here in July, 1807, between Russia and Prussia and Napoleon.

Tilt-hammer, a large and heavy hammer worked by steam- or water-power, and used in forgings. It has been largely superseded by the steam-hammer, but is still advantageously used with light work.

Tilting, the leading item of the contests held at mediæval tournaments, consisted of combats between two or more opposing horsemen armed with lances, the points of which were sometimes, but not invariably, blunted. Sir Walter Scott's description in *Ivanhoe* of the tournament at Ashby-de-la-Zouch affords a lifelike picture of the scene. 'Tilting at the quintain', so named from having early taken place in Roman camps in an open space between the fifth and sixth maniples, continued until the eighteenth century; the figure tilted at was usually a Saracen, as typical of the natural enemy of all good Christians. A similar innocuous amusement was 'tilting at the ring'; failure to pass the lance-point fairly through the circle often spilt a cask of water on the unsuccessful tilter's head.

Timber. Timber might be defined as wood utilized commercially. The term wood is usually held to mean those parts of the vegetable axis possessing a sufficient degree of hardness to be used for purposes where strength is required. Many plants possess woody stems; but bulk and dimensions are required in timber, and accordingly the greater portion of the woods used is derived from trees. Wood, unlike steel, is not homogeneous, but is made up of hollow fibres, most of which are placed parallel to each other in the direction of the vertical axis of the tree. The outer layer or sapwood in a tree is generally lighter in colour, and usually inferior as timber to the heartwood or inner portion, which is much harder and denser and darker in colour owing to the presence of substances with which it is impregnated. Where knots or any abnormal growths occur, the fibres are usually found running in various directions, and any variation from straight grain has a deleterious effect on the strength of the wood. The most common cause of decay in timber is the presence of moisture and the subjecting of the wood to alternating conditions of wetness and dryness, combined with heat and absence of ventilation. Consequently wood buried deep in the ground, placed under water, or kept absolutely dry will not decay. In all other situations timber is liable to decay unless treated with antiseptics or fungicides.

Commercial timber is divided into three main classes: *hardwoods*, *softwoods*, and *conifers*. Generally speaking, hardwoods thrive best in the warmer zones, while softwoods and conifers do well in the colder regions of the earth. Botanically the conifers are quite distinct from the other two groups, but commercially and technically these differences are only of importance in so far as they effect the utility of the wood.

The *physical properties* of timber are of great importance in estimating its value. Weight or density is dependent on the proportion of wood fibres to the other substances contained in the wood, and this will vary in different parts of a tree as well as in different species of trees. The only convenient standard of density is specific gravity, which varies according to the moisture in the wood. Moreover, the crushing strength and stiffness in a piece of wood increase approximately directly as the density. Some of the heaviest timbers are teak, boxwood, and ebony; spruce, Scots pine, and poplar are among the lightest. The relation of wood to moisture is very important. Hardwoods have a lower water content than conifers, while sapwood has naturally a larger water percentage than heartwood. Moisture in wood affects very strongly the shrinkage, expansion, warping, and cracking of timber. Irregularities in shrinkage cause wood to become warped, but careful seasoning or drying reduces this to a minimum. When the strains due to unequal shrinkage are too great for the strength of the timber, cracks are formed; and the more rapidly wood is dried the greater is the tendency to crack. A decrease in water content causes generally an increase in strength, but careless seasoning of timber may bring about defects which neutralize this advantage.

The *mechanical properties* of timber are largely dependent on the physical properties. The strength and hardness of timber are directly proportional to the weight. Defects usually decrease strength; but careful seasoning has beneficial effects. The *elasticity* of timber varies directly with its strength, while flexibility and toughness are usually increased with the quantity of moisture. Hardness in wood is rather an indefinite term, since it depends on the instrument used in cutting it. Ebony and lignum-vitæ are examples of the hardest, while spruce and poplar are amongst the softest of woods. *Durability* is of primary importance. Any timber placed in a situation favourable to the development of fungi will decay; but woods differ much in their resisting power. This depends mainly on the extent to which the wood is exposed to alternating changes from moisture to dryness, for fungi develop better under such conditions. Woods such as conifers and softwoods, which are specially liable to attacks by insects or fungi, can be made of real commercial value by impregnation treatment. Many of the less resistant and lower priced species may be used in the place of more durable but more expensive species, if the former have been properly treated with creosote or some other preservative.

Timbuktu, or **Timbuctoo,** a city of the French Sudan, near the southern edge of the Sahara, an important centre of trade 6 miles north from the main stream of the Niger. It mostly consists of adobe houses, but there are several mosques and a citadel. It depends chiefly on commerce, being a centre of traffic along the Niger, and is accessible from the coast by Senegal-Niger Railway (Kayes-Koulikoro), 344 miles, and by steamer thereafter. Pop. 7000.

Time, in music, is regarded from two quite different standpoints, and may refer either to the pace at which a composition is performed or to its rhythm as indicated by the notational value of the bar. It is unfortunate that such confusion should persist, but it is found in all countries, and there is little prospect that it will ever be removed. In English-speaking countries the difficulty might be solved by using the word *tempo* in the first case and *time* in the second.

Tempo, or pace, is a vital element in the success of any performance, and a wrong choice of tempo, if the error is sufficiently great, can alter entirely the character and meaning of a piece of music. Yet it was not till about the middle of the seventeenth century that composers began to provide tempo indications. At that period the art of instrumental composition was in its infancy, and the limited range of style and expression scarcely demanded that the composer should offer guidance as to rate of speed. As the art advanced it became more and more the custom to indicate the required tempo, and Italy being the foremost country at that time in instrumental composition, it was natural that Italian terms should be used. They are still employed and understood universally, but in later times there is a growing tendency for composers to use the terms of their native tongue, a procedure that can be justified, though it has an obvious disadvantage. Beethoven was one of the first to adopt this practice. In course of time the original significance of the more familiar of the Italian tempo-indications has slightly altered, the fast terms being taken faster and the slow terms slower. Thus, *allégro*, which was formerly used in the sense of 'happy' or 'lively', is now always understood to mean 'quick', and the term 'Allegro agitato' suggests nothing incongruous to the musical mind.

Time, in reference to notation and rhythm, is largely a technical matter, and does not call for detailed mention here. The reader may be referred to any of the numerous textbooks on rudiments of music. It is applied to all kinds of rhythmic combinations, and the particular one in immediate use is indicated by the time-signature, a vulgar fraction representing the proportion of a semibreve which is contained in each bar of the music. There are two general classes of time, simple and compound, the unit of measurement in which is a simple note and a dotted note respectively. A feature of modern compositions is the constant changing of the time-signature. See *Staff*.

Time, Sidereal (Lat. *sidereus*, pertaining to the stars), is so called because of its relation to the apparent diurnal motion of the stars, as opposed to solar time, which depends upon the sun. One rotation of the earth upon its axis does not take 24 hours of ordinary clock time, but is accomplished in 3 min. 55·9 sec. less. Therefore a star, after crossing the meridian, returns again to the meridian in 23 hr. 56 min. 4·1 sec. of ordinary time. The sun takes the additional interval of nearly 4 minutes because of its apparent motion eastward relatively to the stars, which is due to the earth's annual revolution around it. It is of course convenient to the astronomer to keep a time which corresponds with the apparent motion of the stars, and he therefore has a sidereal clock, whose hour hand travels round the 24-hour dial in the sidereal day of about 4 minutes shorter than the solar day. It is necessary to have a definite instant of commencement of the sidereal day, or a point of time at which the sidereal clock is to indicate 0 hr. 0 min. 0 sec. The instant is not defined by the passage of any arbitrarily selected star across the meridian, but by the passage across the meridian of the point of the celestial sphere known as the First Point of Aries. This is one of the two points at which the ecliptic, or sun's apparent annual path, crosses the celestial equator, and is the position which the sun occupies when crossing the equator at the spring equinox, on or about the 21st of March. This point is very nearly, but not quite, fixed with reference to the stars. It has a very slow westward movement, in virtue of which it performs a revolution round the ecliptic in nearly 26,000 years (for explanation, see *Precession of the Equinoxes*). Neglecting this slight motion, each star crosses the meridian at a practically constant interval of time after the crossing of the First Point of Aries, and thus at a constant time on the sidereal clock. The interval is the star's right ascension, measured in time units. It will therefore be evident that, approximately speaking, whenever the sidereal clock at a given place shows a certain particular time, say 5 hr. 40 min., the aspect of the heavens will be always identical with all the stars in the same places.

Sidereal time is therefore useful when the observer wishes to point an equatorial telescope provided with setting circles at a celestial object whose co-ordinates, i.e. right ascension and declination, are known. He first sets the declination circle of the telescope to the object's declination. He consults the sidereal clock. If the time it indicates should be exactly the right ascension of the object, he knows the object will just be crossing the meridian. If it is different, the amount of the difference shows by what angle (*hour-angle*), eastward or westward as the case may be, the object is off the meridian. The hour circle of the telescope is set accordingly, when the object will be in the field of the telescope. If the sidereal clock is precisely correct, or if its error is known, evidently the right ascension of a star can be found by noting at what time on the clock the star crosses the meridian. The instant of the star's crossing the meridian is obtained by observation with the transit circle (q.v.). Conversely, if a star's right ascension is known, observation of the time by the clock at which it crosses the meridian will give the error of the sidereal clock. Although sidereal time is useless for the ordinary purposes of life, mean solar time is practically always obtained by astronomers through the medium of sidereal time. The transit of a star can be observed with great accuracy, whereas the sun is a most unsuitable object for a time observation. Navigators, who require to determine local time by the sextant to find the longitude, are mainly dependent on observation of the sun; but for such purposes the time is required to be found correct only to a second or two, while in fixed observatories, with their large and stable instruments, it may be ascertained within a very small fraction of a second.

For determining sidereal time, stars which are near the celestial equator are more useful than those in higher declinations, because their apparent motion is more rapid. Convenient stars commonly used for the purpose are denominated *clock stars*. The method of observing the star's transit will be found in the article *Transit Circle*. The star's right ascension must be accurately reduced to the date of the observation, by applying corrections in respect of parallax and proper motion (if either is appreciable), aberration, precession, and nutation. For the chief stars, the results are to be found in the *Nautical Almanac*. The difference between the star's right ascension and the observed time of its transit by the clock, each properly reduced, gives the error of the clock. The sidereal clock is always kept to the local sidereal time of the meridian of the observatory, while the mean time clock is kept to the time of the standard meridian of the country—in the case of British observatories, to Greenwich mean time. The difference between Greenwich sidereal time and Edinburgh sidereal time is the same as the difference between Greenwich mean time and Edinburgh mean time; in each case the Edinburgh time is the slower by an amount equal to the longitude of Edinburgh expressed in time (about 12 minutes 44 seconds). Mean time of a place, as kept for astronomical purposes for many centuries back, always agreed with the sidereal time of the place once a year, about 22nd March. About 22nd Sept. it differed by 12 hours. But with the change introduced on 1st Jan., 1925, the mean time clock showing 0 hours at midnight instead of at noon, the coincidence of the times will occur always about 22nd Sept.

Time, Standard. For regulating the ordinary affairs of life, a reckoning of time of day is adopted which is based primarily on the apparent daily motion of the sun. The instant of the sun's upper crossing of the meridian is called noon, and that of its lower crossing is called midnight. The day is considered to commence at midnight, and its two sections are each divided into 12 hours, distinguished as a.m. and p.m. Owing, however, to the varying length of the day (noon to noon), as indicated by the sun, a fictitious or *mean sun* is imagined to exist, which moves uniformly, and time is made to conform to its position (see *Equation of Time*). All the places on one terrestrial meridian have noon (either apparent or mean noon) at the same instant, but places in different longitudes have different times, varying at the rate of 1 hour for every 15° of longitude, or 4 minutes for 1°. Before the introduction of railways, the disadvantages of diverse local times were not greatly felt, and most places kept the local time. When railway travelling became common, it was necessary for a uniform time to be used at all the stations of a railway. Greenwich mean time was generally adopted by the railway companies in Great Britain, and gradually came to be used for most purposes of precision. In 1880 the use of Greenwich mean time was legalized, and, though it was not made compulsory, its employment became practically universal. In 1916 and subsequent years, the 'daylight saving' scheme was put into operation during a period of some months in the middle portion of the year. During that period the standard time was appointed to be 1 hour in advance of Greenwich mean time, which latter was regarded as normal time, while during the rest of the year normal time was to be kept (see *Summer Time Act*; *Daylight Saving*). It was then that for the first time Greenwich mean time was definitely prescribed by law to be the 'time for general purposes', though for part of the year only. It was also provided that Greenwich mean time might continue to be used during the whole year for the purposes of astronomy, meteorology, and navigation.

During the latter part of the nineteenth century, it was usual for most of the chief countries to use a standard time, determined in each case by the meridian of the capital city. They also commonly used this meridian for the reckoning of longitudes. Owing, however, to the large merchant fleet and commerce of Britain, the Greenwich meridian was mainly used as prime meridian for all maritime purposes. Paris mean time is 9 minutes ahead of Greenwich, Berlin time 54 minutes, Rome time 50 minutes, &c. Differences of such diverse amounts were found to be very inconvenient, and, as a result of international and astronomical conferences, standard times were introduced based on Greenwich mean time, differing from it by an integral number of hours, and using the same minutes, although in a few cases differing further by an odd half-hour. Thus most European countries now use as their normal time (1) Greenwich mean time; or (2) Mid-European time, one hour faster; or (3) East European time, two hours faster, whichever is the most accordant with their geographical position. Most countries in other continents employ these or other 'zone times' similarly based on the Greenwich meridian. Navigators had long been accustomed to use 'ship time', altering their clocks each day to the local time of the longitude in which the ship was situated at noon. But from about 1920 it has become the practice at sea also to use zone times, altering the clocks by an exact hour for each 15° of longitude, upon an average, that the ship has sailed eastward or westward. The minute hands of the clocks thus always show the Greenwich time minute.

It has sometimes been suggested that Greenwich mean time should be used everywhere throughout the world, thereby abolishing all other standard times. This, however, would have grave disadvantages. At many places each day and calendar date would begin at some hour during the daylight, allotting two parts of the same period of daylight to different days of the week and month. Or, if otherwise arranged, the day would require to begin not at zero time on the clock, but at some odd hour and minute. It is true that one might soon get accustomed to calling the midday hour '7 o'clock', or anything else. But on travelling to any other longitude, he would find his habits of thought as regards time completely upset by the changed meaning of the hours of the day. The use of zone times preserves a sufficiently definite significance to the nomenclature of the hours to meet practical convenience.

Standard time is regularly determined at Greenwich and other observatories in this country, mainly by observation of the transit of stars, and is disseminated to the railways, post offices, &c., by electric current. Standard time is also sent out daily by wireless signals from certain stations on the Continent. These signals may be picked up by ships at sea, which can therefore now in many cases be practically independent of the chronometer.

Times, The, a London journal which has long held the leading position among British newspapers, was established in 1785 by John Walter, originally an underwriter at Lloyds, as *The Daily Universal Register*, the additional title of *The Times* being prefixed in 1788. The paper's early career was stormy; for in 1789 Walter suffered a sentence of fine and imprisonment for having published an article reflecting on the Duke of York. Paper and proprietor survived the punishment, and were far on the road to success when, in 1812, the first John Walter died. Under his son and successor, John Walter the second, *The Times* advanced rapidly in power and importance. In 1814 steam was introduced as motive power to the printing-room, and this was only the first of a long series of mechanical improvements made in the production of the paper; in 1860 stereotype printing was established, and nine years later the Walter press was perfected. The news-collecting and literary side of the journal more than kept pace with these advances. Special attention had long been devoted to securing foreign news, and, as in the case of Waterloo, the paper frequently forestalled the Government in receiving early tidings of important over-sea events. In 1841 Thomas Barnes, after an editorship extending for a quarter of a century, was succeeded in the chair by John Delane, then only twenty-four; under his rule the paper gained the unofficial title of 'The Thunderer' from the vigorous leaders supplied by Edward Sterling, father of the later famous John. Later editors of distinction were Thomas Chenery, who succeeded Delane in 1877; and George Earle Buckle, who assumed the reins in 1884. Macaulay and Moore supplied *The Times* with poetry; Thackeray was a leading reviewer, besides contributing much original matter; while Brougham and Beaconsfield both wrote for its columns. In 1841 the paper's discovery and exposure of an elaborate and gigantic fraud upon bankers, which was being engineered from France, gave no small impetus to an ever-increasing success. The exposure led to an action at law against *The Times*. Prominent London financiers raised a fund to pay the paper's costs; and this, being refused by the proprietor, was devoted to the foundation of scholarships at Oxford and Cambridge, and to the placing of commemorative tablets in *The Times* office and the Royal Exchange. A further public service due to the energy and enterprise of the paper was the exposure of the gross mismanagement of the Crimean War, as set forth in the letters of its special correspondent, Dr. (later Sir) William Howard Russell. In 1887 *The Times* articles on 'Parnellism and Crime' led to the establishment of the Parnell Commission and the exposure and suicide of the forger Piggott. The third John Walter had succeeded as proprietor in 1847, his place being taken in 1894 by Arthur Walter. In 1908 the great newspaper became the property of a company, with the late Lord Northcliffe as financial chief. Lord Northcliffe's shares in *The Times*, as well as those of Sir John Ellerman, were acquired by Mr. John Walter in Oct., 1922, and Major the Hon. J. J. Astor was associated with Mr. Walter in their acquisition. In 1895 the paper published *The Times Atlas*, which was shortly followed by a *Gazetteer*; later enterprises of a like nature were the production of an edition of the *Encyclopædia Britannica*, a reprint of the earlier volumes of *Punch*, a *History of the War in South Africa*, &c. The *Times* Book Club dates from 1905. These innovations have, in the opinion of some readers of the older school, somewhat shaken the great journal on that pedestal of dignified infallibility on which it so long stood secure; but it undoubtedly remains the leading paper of the day. —Cf. *The Times Centenary Number* (1888); E. T. Cook, *Delane of The Times* (1915).

Timo'leon, Greek general, liberator of Sicily from the dominion of Dionysius the Younger, was born at Corinth about 411 B.C., died 337 B.C. He was passively involved in the assassination of his brother Timophanes, who wished to usurp the supreme power, and spent twenty years in voluntary exile. On the invitation of his fellow-citizens he returned and took command of the troops sent to Sicily to aid the Syracusans against Dionysius the Younger and the Carthaginians (344 B.C.). He expelled Dionysius from Syracuse (343 B.C.), and totally routed the Carthaginians (339 B.C.). Having restored their liberty to the Syracusans, and recalled the exiles and fugitives, he gave the citizens a new and more stable constitution, and finally, having accomplished his mission, voluntarily laid down his power and retired into private life. All Sicily mourned his death, and he was buried at the expense of the city.

Timor, the most easterly of the Sunda Islands, Malay Archipelago, politically divided between the Netherlands and Portugal. *Physical.*—It is traversed from east to west by rugged limestone mountains (6000–7000 feet average altitude) running parallel to the coral-fringed coast-line, and furrowed by the valleys of short, turbulent streams. The flat coastal plains are humid and malarial, and the mean daily temperature is from 80° to 100° F. Above the 2000–3000 feet level, however, anopheline mosquitoes disappear (at least in the Portuguese area), and malaria is replaced by hill diarrhœa. There are two seasons: (1) wet (November–April), and (2) dry (May–November). Dutch Timor possesses many mud volcanoes. *Political.*—The divisions are as follows:

(1) *Dutch Timor*, the western half of the island, excluding the enclave of Ocussi (Portuguese) on the north coast. There is a coast-line of 450 miles broken by Kœpang Bay, upon which stands the port of Kœpang. Tetum in the east, Dawan in the west, and Malay in Kœpang are the chief languages; the people (pagan) are mainly Timorese, Belonese, and Kœpangs (also found in Samau Island, where their rajah is located). Kœpang is the administrative centre of Timor Archipelago (26,410 sq. miles; pop. 1,000,000). *Production.*—Maize is the native staple; rice, wheat and millet, sago, coco-nut palms, tobacco, onions, vegetables, and fruit are raised. Small horses are exported, with honey

and wax, &c. *Area*, 6000 sq. miles; pop. (very doubtful), 350,000.

(2) *Portuguese Timor*, the eastern half of the island, including the enclave of Ocussi (950 sq. miles) and Kambing Island (55 sq. miles); total area, 7330 sq. miles; pop. 377,800. There is a coast-line of 500 miles; the Ocussi seaboard is 35 miles long. The natives are mainly pagan Belonese; but there are also Arabs, Chinese, and Portuguese. Tetum is the *lingua franca.* Dili (Dilly) is the capital and chief port (pop. 4000). *Production.*—Coffee is the greatest export, with sandalwood second and copra third. Skins and hides, buffaloes, bees-wax (from hordes of wild bees), cocoa, and horn are also exported. Rice, alcohol, and textiles are the chief imports. See *Malaya* (section *Malay Archipelago*); *Sunda Islands.*

Timorlaut, or Tenimber Islands, a Dutch group of islands of the Malay Archipelago. The largest, Timorlaut or Yamdena, is about 75 miles long by 25 miles broad. Selaru (299 sq. miles) and Larat (199 sq. miles; pop. 2000) with thirteen smaller islands complete the group (area, 2096 sq. miles), which belongs to the Residency of Amboyna. The islands are low and calcareous. Products include maize, fruit, potatoes, palm-oil, and trepang. Pop. 25,000.

Timothy (Timotheus) is the name, in the New Testament, of a younger colleague of St. Paul. He was the son of a mixed marriage; his Jewish mother had married a pagan. Consequently, although he received a religious training, he was not circumcised. The Apostle converted him at Lystra, a Roman colony in Lycaonia, and enlisted him in the mission. To facilitate his efforts among Jews, Paul had him circumcised. Joining Paul and Silvanus, he took an active part in the first mission to Europe; with the Macedonian Churches, and especially with that at Thessalonica, he had close relation, acting as Paul's deputy (see *Thessalonians, Epistles to*). Two years after the party left Corinth for Asia, Timotheus worked there, and was employed by Paul in communicating with the Church at Corinth. He accompanied Paul to Corinth on his final visit, but apparently not on his voyage to Rome, though he joined Paul there later. We may infer from *Acts*, xx, 4–5, and from the tradition underlying the epistles to Timothy, that he was put in charge of the Christians in and around Ephesus, with semi-episcopal powers. An enigmatic allusion in *Heb.* xiii, 23 throws no clear light upon his movements, for " our brother Timothy is set at liberty " may mean " our brother Timothy is now free "; it does not necessarily imply imprisonment. Besides, no one knows who wrote *Hebrews* or to whom it was written.

His character shows a warm loyalty to Paul. He was evidently a trustworthy, capable agent of the Church. But there was a vein of backwardness in him, a shrinking from responsibility, and even a tendency to timidity, against which his senior warns him.

All that is known of him is preserved in *Acts*, xvi, 1–3; xvii, 14–15; xviii, 5; xix, 22; xx, 4–5; and the references in Paul's epistles (*1 Thess.* i, 1; iii, 2, 6; *2 Thess.* i, 1; *1 Cor.* iv, 17; xvi, 10; *2 Cor.* i, 1, 19; *Phil.* i, 1; *Col.* i, 1; *Philem.* i; and the pastoral epistles).

Timothy, Epistles to, two books of the New Testament attributed to St. Paul. These epistles, along with that to Titus, are called the pastoral epistles, as to the genuineness of which there has been considerable controversy. By the early Christian Fathers they were almost universally accepted as genuine, and their genuineness is also supported by external testimony. They were, however, rejected by Marcion, Basilides, and other Gnostic heretics. In modern times both views have been ably advocated. Their genuineness is chiefly attacked on the grounds that their style differs from that of the acknowledged epistles of St. Paul, that the heresies alluded to in the epistles betray a later age, that the ecclesiastical polity of the epistles is too complete to belong to the time of the Apostles, and that it is difficult to find any part of the Apostle's life to which they can be assigned. Biblical critics generally meet the last difficulty by assigning them to a period after the close of the narrative in the *Acts*, the second epistle to Timothy being written while St. Paul was undergoing a second imprisonment in Rome.

Timothy-grass (*Phleum pratense*), a hard coarse grass with cylindrical spikes from 2 to 6 inches long. It is used mixed with other grasses for permanent pasture, and grows best in tenacious soils. It is extensively cultivated throughout Great Britain, and also in North America. Timothy Hanson first recommended it, hence its name.

Timur, Timur Beg, Timur Lenk (that is, *Timur the Lame*), or **Tamerlane,** Mongol conqueror, born in the territory of Kesh, near Samarkand, in 1336, died in 1405. His ancestors were chiefs of the district, and Timur by his energy and abilities raised himself to be ruler of all Turkestan (1370). By degrees he conquered Persia and the whole of Central Asia, and extended his power from the great wall of China to Moscow. He conquered India (1398) from the Indus to the Ganges delta, and on his way from India to meet the forces of Bajazet, the Turkish Sultan, he subjugated Bagdad, plundered Aleppo, burned down the greater part of Damascus, and wrested Syria from the Mamelukes, after which he overran Asia Minor with an immense army. Bajazet's army was completely defeated on the plain of Ancyra (Angora) in 1402, and the Sultan was taken prisoner. The conquests of the Tatar now extended from the Irtysh and Volga to the Persian Gulf, and from the Ganges to the Grecian Archipelago. He was making mighty preparations for an invasion of China when death arrested his progress at his camp at Otrar, beyond the Syr-Darya, and his empire immediately fell to pieces. He was fanatical in his religion, but in a measure a patron of science and art, and he is also the reputed author of the *Institutions of Timur* and the *Autobiography of Timur*, both translated into English. Timur is known in literature through Marlowe's drama *Tamburlaine the Great.*

Tin, a soft, white, ductile metal; atomic weight, 118·7; chemical symbol, Sn (from Lat. *stannum*). It has been shown by Aston to be a complex element, consisting of 7 or 8 isotopes (q.v.). Tin appears to have been known in the time of Moses; and the Phœnicians traded largely in the tin ores of Cornwall. The mountains between Galicia and Portugal, and those separating Saxony and Bohemia, were also productive of tin centuries ago, and still continue unexhausted. Tin occurs in the Malay Peninsula, the Island of Banca, India, Mexico, Chile, Peru, the United States, Australia, &c. There are only two ores of tin: the native dioxide, called *tin-stone* or *cassiterite*; and the double sulphide of tin and copper, called *tin-pyrites*. The former is the only ore used for obtaining metallic tin in quantity. It occurs either in the massive form or as distinct quadratic crystals which have a dark-brown colour and metallic lustre. It is usually contaminated with sulphide of copper, arsenical pyrites, and tungsten compounds. It is found in veins in metamorphic or igneous rocks, such as granite, porphyry, slate, &c., and is then known as *mine-tin*, or sometimes in alluvial deposits formed by the denudation of the above veins, and is then known as *stream tin*. The ore is first ground and washed, and then roasted in a reverberatory furnace to expel the sulphur and arsenic. Mixed with limestone and fuel, it is again fused in a furnace for about eight hours, the earthy matters forming a slag with the lime, while the oxide of tin, reduced to a metallic state, falls by its own weight to the bottom, and is drawn off. The tin, still impure, is again moderately heated, when it melts and flows off into the refining basins, leaving the greater part of the foreign metals in a solid state. The molten tin is further refined by stirring with a wooden pole, or by 'tossing', and is cast into blocks and sold as *block-tin*, the purest specimens being called *refined-tin*. Pure tin has a fine white colour like silver. It has a slightly disagreeable taste, and emits a peculiar sound when bent, known as the 'cry' of tin. Its hardness is between that of gold and lead, and it is very malleable. Specific gravity, 7·29; melting-point, about 232° C. It loses its lustre when exposed to the air. At very low temperatures it passes spontaneously into another modification known as *grey-tin*; this has a specific gravity 5·8, and falls to a powder. Ordinary tin can be rolled out into very thin sheets known as *tin-foil*. Oxygen combines with tin, forming protoxide of tin or *stannous oxide* (SnO), and dioxide or *stannic oxide* (SnO_2). The compounds of chlorine with tin are dichloride or *stannous chloride* ($SnCl_2$), and *stannic chloride* ($SnCl_4$). Stannic chloride has long been known as *the fuming liquor of Libavius*, so called from Libavius, a chemist of the sixteenth century. *Stannic sulphide* (SnS_2) has long been known in chemistry as *aurum mosaicum* or *mosaic gold*. Tin unites with arsenic and with antimony, but not readily with iron. Alloyed with copper it forms bronze, bell-metal, and several other useful alloys. With lead it forms pewter and solders of various kinds. Its oxides are used in enamelling and for polishing metals, and its solution in muriatic acid is an important mordant in dyeing, rendering several colours, particularly scarlet, more brilliant and permanent. See *Tin-plate*.

Tin'amou, South American birds of the family Tinamidæ, somewhat resembling a partridge, and varying in size from that of a pheasant down to that of a quail. They are more nearly allied to the ostrich, &c. (Ratitæ), than are other flying birds. Typical genera are Tinamus (ten species), Crypturus (at least thirty species), and Rhynchotus (two species). To the last belongs the great tinamou (*R. rufescens*), which is about 18 inches long, and inhabits the forests of South America.

Tin'dal, Matthew, English deist, born about 1653, died in 1733. He entered Lincoln College, Oxford, in 1672, and became a Fellow of All Souls in 1678. After the Revolution he sat as a judge in the Court of Delegates. In 1706 he published a treatise entitled the *Rights of the Christian Church*, attacking hierarchical supremacy. This work excited the animosity of the High Church clergy, and the House of Commons ordered it, together with two defences of it written by Tindal, to be burned by the common hangman. In 1730 he published his most famous work, *Christianity as Old as the Creation, or the Gospel a Republication of the Religion of Nature*, in which he maintains that there has been no revelation distinct from the internal revelation of the law of nature in the hearts of mankind.—Cf. Sir Leslie Stephen, *History of English Thought in the Eighteenth Century.*

Tinder, any highly inflammable material readily ignited (without explosion) from a spark, and employed as a means for kindling a fire in days preceding the invention of lucifer matches. The tinder, made of charred linen, touch-wood, decaying wood, or touch-paper, was ignited by means of sparks produced by striking flint against steel, the whole apparatus, tinder, flint, and steel, being contained in a metal box termed a tinder-box.

Tinnevelly, a maritime district and town of the Madras Presidency, India. The district faces the sea on east and south, and the Western Gháts on the west, and is traversed by the Tambraparni River (70 miles), emptying to the Gulf of Manaar. Rice and rági are the staple food-grains. 23 per cent of the people live in towns. The town is the largest in the district, and stands on the Tambraparni opposite Palamcottah (the district head-quarters; pop. 40,000). It is on the South Indian Railway. Area (district), 4353 sq. miles; pop. 1,800,000; pop. (town), 45,000.

Tinos, or **Tenos**, an island in the Grecian Archipelago, one of the Cyclades, immediately south-east of Andros; area, about 85 sq. miles. It produces barley, silk, wine, figs, oranges, and honey; and black, white, and green marble is worked by an English company. Tenos, or St. Nicolas, and Port Panormos are the chief harbours. Pop. (island), 12,000; (town), 3000.

Tin-plate consists of thin sheets of mild steel covered with a very thin coating of tin, and is very largely used for the manufacture of vessels used in the canning of fruit, milk, meat, &c. It is also used for the storage vessels used for petrol, biscuits, and tobacco. The manufacture of tin-plate is one of the most important industries of South Wales, and large quantities are also produced in Germany and the United States.

In order that the tin may act as an efficient protector against oxidation and rusting, it is absolutely necessary that the metal shall completely cover the surface of the steel, and if this be not the case, for example, if pinholes uncovered by tin be present on the surface, then the tendency for rusting to commence at these points is actually greater than in the case of steel unprotected by tin, owing to the fact that round about these uncovered spots the iron and tin will form an electrolytic couple in the presence of moisture, in which the iron will act as the anode and will tend to pass into solution in preference to the tin. For the manufacture of tin-plate, mild steel containing about 0·1 per cent of carbon is first rolled into very thin sheets. These sheets are then pickled to remove scale from the surface, then annealed, cold rolled, and again annealed. They are again pickled in acid, as the complete removal of oxide is most important. They are then fed automatically through a bath of molten tin, protected from oxidation by means of a layer of zinc chloride, then through a layer of palm-oil and through a pair of rolls for the removal of excess tin. They are then cleaned by a machine using bran or a mixture of gypsum and sawdust, and are polished with sheepskins.

Tintoretto, the name given to the Venetian painter Jacopo Robusti on account of his father's trade, that of a dyer (*tintore*). He was born at Venice in 1518, died there in 1594. He studied for a few days under Titian, but, being dismissed without explanation by his master, he afterwards pursued his studies alone, and endeavoured, in his own words, to unite Titian's colouring with the drawing of Michelangelo. He is almost alone among the great Venetian painters of his generation in never leaving Venice, save for a short visit in his old age to Mantua to place in position some battle-pieces he had painted for the duke. He was chiefly employed by the citizens, the churches, the fraternities, and the Government of Venice, one of his first important commissions being from the Scuola di San Marco in 1547, for which he produced a series dealing with the miracles of St. Mark. In 1559 he began the decoration of the scuola and church of San Rocco, where still remains one of the most representative collections of his work, including a famous *Crucifixion*, completed in 1565. In 1561 came his first commission from the State, for which he produced an elaborate series of decorations in the Ducal Palace, in which the *Paradise* (finished about 1584) represents the culmination of his art. Other notable works are: the *Marriage of Cana* (1561, Salute Church, Venice); *The Last Judgment* (S. Maria dell' Orto); *The Last Supper*, and *Gathering of the Manna* (S. Giorgio Maggiore); and a series dealing with the life of S. Catherine in the church dedicated to that saint. He also painted a remarkable group of portraits, unequal in quality, but the best of them marked by rich sombre tone and penetration into character. His earlier work shows markedly the influence of Titian in its colour and use of light and shade, and of Michelangelo in the treatment of form. Later, while Michelangelo still influenced his draughtsmanship, his colour became cooler, and he developed the use of light and shade to give silhouetted forms, whence he builds up his designs. His facility was immense, and sometimes led to empty and mechanical handling. But his best work has proved a most potent influence in later art. Outside Venice, good work by him is rare; but the National Gallery has two fine and characteristic examples.

Tip'pera, a district of India, in the Chittagong division of Bengal. It is an alluvial plain, and the chief river is the Meghna. There are three harvests, rice, jute, oil-seeds and food-crops being grown. The Assam-Bengal Railway traverses the district. Comilla (the head-quarters), Brahmanbaria, and Chandpur are the chief towns. Area, 2499 sq. miles; pop. 2,200,000.

Tippera'ry, an inland county of Ireland, in the province of Munster; area, 1662 sq. miles. The principal mountain groups are the Knockmealdown, the Galtees, and the Keeper and Devil's Bit Mountains, the greatest elevation being 3000 feet. The chief crops are oats, potatoes, and wheat. The level country forms part of the great central plain of Ireland, and includes some branches of the Bog of Allen. Mineral products include coal, copper, zinc, and argentiferous lead; slates of good quality are extensively raised near Killaloe. Grazing is the principal employment, and there are numerous dairies. Chief towns: Clonmel, Carrick-on-Suir, Nenagh, Thurles, Cashel, Tipperary, and Roscrea. Pop. 152,433.

Tipperary, the county town of Tipperary County, Ireland, on the Arra. It has an endowed grammar-school, a convent, a butter market, and a corn and provision market. The chief trade is in butter. Pop. 6200.

Tippoo Sahib, Sultan of Mysore, son of Hyder Ali (q.v.), born in 1749, died in 1799. He succeeded his father in 1782, and continued the war with the British in which his father had been engaged, but in 1784 was induced to sign the Treaty of Mangalore on advantageous terms. In 1789 he attacked the Rajah of Travancore, an ally of the British, which occasioned the second Mysore War. An offensive and defensive alliance was concluded (June, 1790) between the East India Company, the Peishwa of the Mahrattas, and the Nizam. In the campaign of 1790 and 1791 several places were reduced by the allies, and Tippoo was finally besieged in his capital, Seringapatam. He was compelled to cede half of his dominions, but hostilities broke out again in 1799. Tippoo was defeated in two battles, and retreated to Seringapatam. On 4th May, General Baird reduced the place by storm, and Tippoo perished in the assault.

Tipton, an urban district of Staffordshire, England, near Dudley. It depends chiefly on its manufactures of heavy iron goods. Pop. (1921), 34,181.

Tip'ula, a genus of dipterous insects or flies, of which the common crane-fly or daddy longlegs (*T. oleracea*) is a typical species. See *Crane-fly*.

Tirah, a mountainous region of the North-West Frontier Province of India, comprising the area watered by the Khanki Toi, Khurmana, and Mastura Rivers. In their upper courses the valleys (5000–7000 feet altitude) afford a summer pasturage, but are snow-bound in winter, when the climate is intensely cold. Nomadic Afridi tribes people Tirah for a part of each year.

Tirana, the capital of Albania, in the valley of the Rushka. Viticulture is practised, and there is a brick-kiln, where tiles and terra-cotta vases are also made. Pop. 12,000.

Tiraspol, a town of the Ukraine, in the former Russian government of Kherson, near the Dniester and on the Odessa-Kishinev Railway. Tobaccos are manufactured. Pop. 35,240.

Tiree', an island of the Inner Hebrides, Scotland, in Argyllshire. It is about 14 miles long, and reaches 6 miles in breadth, is generally low and flat, but has several heights of 400 feet. Agriculture and fishing are the leading industries. Tiree is treeless, and is noted for its snipe. Skerryvore lighthouse is within the parish. Pop. (1921), 1716.

Tirlemont (tirl-mŏṇ), a town of Belgium, in Brabant. It has manufactures of woollens, brewing and tanning industries, and a grain trade. Pop. 19,000.

Tirol, a province of the Republic of Austria, comprising Tirol proper and the detached district of Lienz. Tirol is divided into seven districts and the city of Innsbruck. Innsbruck is the capital. Area, 4790 sq. miles; pop. (1920), 306,300 (about 60 per cent German-speaking Roman Catholics). Physically the region is mountainous, traversed by the Lechtaler Alps, Stubaier Alps, Kitzbühler Alps, Ötztaler Alps, and the northern slopes of the Zillertaler Alps, and drained to the Danube by the Inn. Agriculture and stock-raising are progressive, and about 40 per cent of the region is forest. The ancient mines of Tirol are now relatively unimportant, and manufactures are insignificant; the real wealth of the country lies in its scenery and its position as custodian of the principal routes from Germany into the Trentino. Innsbruck is the centre of the railway system, which comprises: (1) an eastern line running via Jenbach (pop. 2281; an iron-smelting town) and Wörgl (pop. 4000; for Salzburg, 120 miles, via Kitzbühel, which is noted for its mineral spring and the working of copper and iron; pop. 2500) along the Lower Inn Valley to Kufstein (pop. 6662) for Munich. Innsbruck to Kufstein is 48½ miles. (2) A southern line runs via Steinach (pop. 2000) and the Wipp Valley to Brenner (pop. 461), where there are two tepid mineral springs. From Brenner the line is continued through the Trentino (q.v.). (3) The western line follows for a time the Upper Inn Valley and reaches St. Anton and the Arlberg Tunnel (see *Alps*), 68 miles from Innsbruck. All the towns mentioned stand high, and for this reason the climate is generally cold, e.g. the mean annual temperature at Innsbruck is 48° F. Hall (q.v.) is a salt-manufacturing town. Mineral operations have been confined for centuries to the Inn Basin, especially centring on Schwaz (pop. 8000) and Rattenberg (pop. 1000).

Electrification.—The railway north from Innsbruck is now electrified, and connects at Mittenwald with the South Bavarian electric system. The lines from Tirol to Italy and from Innsbruck to St. Anton (for Switzerland) are also electrified. Further water-power resources are estimated at 320,000 h.p., or, with Vorarlberg, 380,000 h.p. Over 43,000 h.p. additional have been put into service, and many schemes are afoot for the further development of Tirolean water-power to increase the power generated to 333,000 h.p. Among these, the Achensee project, devoted to the exploitation of the largest lake in Tirol, is planned to give a total generated power of 134,000 h.p. (according to Quigley), " destined to supply the whole of Northern Tirol with light and power and contribute to the further electrification of the Austrian Federal Railways ".

Lienz.—The district is subdivided into the districts of Lienz, Windischmatrei, and Sillian, and has a population of 40,000 to 50,000 (German-speaking Roman Catholics mainly). Windischmatrei (pop. 900) and Sillian (pop. 700) are market towns, the latter having baths at Weitlandbrunn in the vicinity. Lienz town is the ancient *Aguontum Noricum*, and is the administrative centre of the district. It is a summer-resort and a centre for sight-seeing in the Tauern and the Dolomites. There are baths at Leopoldsruhe and Jungbrunn. Communication is made at Franzensfeste (Fortezzo) with the Brenner line (see *Trentino*), running via Innichen (frontier), Sillian, and the Drave Valley (i.e. along the Pustertal) to Lienz, whence the line is continued to Villach. Innichen to Lienz is 26 miles.

Tirpitz, Alfred von, German admiral and statesman, born 1849. He entered the Prussian navy as a cadet (1865), and became Chief of Naval Staff in 1892. From June, 1897, till March, 1916, when he retired on account of a conflict of interests with Bethmann-Hollweg, Tirpitz was Naval Secretary (afterwards Minister) of State, and it was to him that the naval might of Germany was really due. His object has been disputed, but his own views are to be found in his *Erinnerungen* (Memoirs), published during 1919. Tirpitz was ennobled in 1900. His advocacy of a ruthless submarine campaign, and the fact that he was the head of the *Vaterlandspartei*, the ' no peace by compromise party ', made him detested by the Allies during the European War; and after the German Revolution he found popular opinion so much against him that he was compelled to retire to Switzerland for a time.

Ti'ryns, a very ancient ruined city of Greece, in the Peloponnesus, in the plain of Argolis, about 3 miles from the sea. The foundation of the city was ascribed to Prœtus, and in 468 B.C. it was destroyed by the Argives. There are the remains of Cyclopean walls, and of a palace of the eleventh or tenth century B.C., excavated by Schliemann in 1884–5.

Tischendorf (tish'en-dorf), Lobegott Friedrich Konstantin, German Biblical critic, born in 1815, died in 1874. He studied at Leipzig, and in 1859 became professor of theology. He made several visits to the East, and brought back valuable MSS., the most remarkable being (in 1859) the famous *Codex Sinaiticus* (see *Codex*). Tischendorf was continually engaged in editorial labours, and was broken down by overwork in 1873.

Tissues, (1) in animal anatomy, the texture or grouping of anatomical elements of which the systems of organs are composed. Thus in special histology we speak of *muscular tissue*, or flesh; *osseous tissue*, or bone; *adipose tissue*, or fat; *cartilaginous tissue*, or gristle; *pigmentary tissue*, or colouring-matter seen in the skin, &c.; *areolar*, *cellular*, or *connective tissue*, widely distributed in every part of the body, and serving to bind together and consolidate other parts and tissues. (2) In botany, tissues of plants are conveniently classified according to the purposes which they serve. The principal forms are: (*a*) *vascular* or *conducting tissues* (q.v.), largely made up of tubular structures. (*b*) *Mechanical* or *supporting tissues*, which are mainly responsible for the mechanical strength of roots and shoots; they consist typically of long, pointed, thick-walled cells (*fibres*). (*c*) *Protective tissues*, including *epidermis*, *cork*, &c. (*d*) *Absorbing tissues*, of which the piliferous layer of roots is the type. (*e*) *Parenchyma*, composed of rounded, oblong, or polyhedral cells, and concerned with a variety of functions, such as carbon-assimilation, storage, &c. See *Botany*.—Cf. G. Haberlandt, *Physiological Plant-anatomy*.

Tisza, Koloman, Hungarian statesman, born 1830, died 1902. He entered the Hungarian Parliament in 1861, founded a Liberal party of advanced views, and was Prime Minister from 1875 to 1890. During his term of office he attempted the Magyarization of Transylvania, but opposed the occupation of Bosnia and Herzegovina.

Tisza, Stephen (Hung. *Istvan*), Count, Hungarian statesman, born 1861, died 1918. A son of the preceding, he entered the Hungarian Parliament in 1886, and came rapidly to the front as an expert on the land question, which his *Magyar Agrarpolitik* dealt with authoritatively, and he took also a leading part in educational and financial problems. He was Prime Minister from 1903 to 1905, governing, or attempting to govern, under impossible conditions of obstruction which amounted almost to anarchy, and in 1905 his appeal to the country was rejected, and he retired. In 1913 he again assumed the premiership, and, with Count Berchtold, he framed the terrible Serbian ultimatum of 1914. His truce with the Opposition lasted until 1917, when he again resigned, and was assassinated on 31st Oct., 1918. Tisza was probably the greatest minister the Dual Monarchy ever possessed, and his power was certainly exceeded by none.

Titanium, an element discovered in 1791. Symbol, Ti; atomic weight, 48·1. It is found combined with oxygen in several minerals, and especially in iron ores, known as titaniferous iron ores. It is a dark-grey, very heavy, amorphous powder, in many respects resembling silicon. Its oxide forms the minerals *rutile*, *anatase*, and *brookite*. The ores include *menachanite*, from Menachan in Cornwall, where it was originally found; *iserine*, from the River Iser in Silesia; &c.

Titans, in Greek mythology, the sons and daughters of Urănus (Heaven) and Gē (Earth). They were twelve in number, six sons and six daughters. They rose against Urănus and deposed him, raising Cronus, one of their number, to the throne. They were afterwards overcome by Zeus, and thrown into Tartarus.

Tithe (A.-S. *teotha*, one-tenth), the tenth part of the produce of land allotted to the maintenance of the clergy and other ecclesiastical purposes. The gift of Abraham to Melchisedec is the earliest instance on record of the payment of tithes (" He gave him tithes of all ", *Gen.* xiv, 20); the vow of Jacob at Bethel is the second (" Of all that thou shalt give me I will surely give the tenth unto thee ", *Gen.* xxviii, 22). The payment of tithes was enjoined by the law of Moses, but was not adopted by the early Christian Church, which depended upon the freewill offerings of its adherents. By the end of the fourth century, however, we find the obligation of tithe-giving firmly established as a religious duty, though some centuries were yet to pass before it received, in England, the recognition of the State. That further step was taken in 970, when the laws of Edgar enacted penalties for the non-payment of tithes. There was now a civil as well as a religious sanction. Tithes were originally distinguished as 'prædial', or the produce of land; 'personal', or the profits of the arts and crafts; and 'mixed', or the produce of live-stock; but all distinctions were rendered obsolete by the Tithe Commutation Act, 1836, which provided for an annual money payment or tithe-rent charge based upon a fixed valuation, but varying with the average price of corn over a period of seven years. The liability may be redeemed by arrangement with the Board of Agriculture. In 1913 £100 of tithe-rent charge was worth £74, 14*s.* 9½*d.* It rose in value each year until 1918, when it was fixed for seven years at £109, 3*s.* 11*d.* After 1925 it will be based on the average prices for the preceding fifteen years.

Tithing, an ancient subdivision of England, forming part of the hundred, and consisting of ten householders and their families held together in a society (all being bound for the peaceable behaviour of each other) the chief of whom was the *tithing-man*.

Titho′nus, in Greek mythology, a son, or brother, of Laomedon, King of Troy. He was beloved by Eos (Aurora, Morning), who importuned Zeus to make him immortal. Her prayer was granted, but she had neglected to ask for continual youth, and in time her lover took on all the signs of extreme age. Tithonus's prayer to the gods to be relieved of the burden of old age was answered by his being metamorphosed into a grasshopper.

Titian (tish′i-an), or **Tiziano Vecellio** (tit-si-a′no), Venetian painter, born 1477, died 1576. He studied under Giovanni Bellini of Venice, and came under the influence of Giorgione, with whom he was associated in executing the frescoes on the Fondaco dei Tedeschi, which have now almost completely disappeared. Typical of this period are *Sacred and Profane Love* (Borghese Gallery, Rome), and the *Madonna of the Cherries* (Vienna). In 1511 he was invited to Padua, where he executed three frescoes in the Scuola del Santo; and in 1516 made his first recorded visit to the court of the Duke of Ferrara, for whom he painted the *Worship of Venus* and a *Bacchanal* (now in the Prado), a number of portraits, and (in 1523) *Bacchus and Ariadne* (National Gallery). In 1516 also he was commissioned by the State to paint a battle-piece in the Ducal Palace; but the picture was not completed until 1557, and was destroyed by fire in 1577. All this early work shows strongly the influence of Giorgione in its pagan joyousness and rich glowing colour. The famous *Assumption of the Virgin* (Venice Academy) marks the emergence of an independent art, one characterized by great opulence and splendour, but sensuous and materialistic. Characteristic are the *Pesaro Madonna* (Frari, Venice); *The Presentation of the Virgin* (Venice Academy); *Death of St. Peter, Martyr* (destroyed by fire in 1867); and an important group of portraits. No painter was ever more sought after than Titian, and among his friends and patrons were all the principal personages of the day, including Federigo Gonzaga of Mantua and the Emperor Charles V. It was probably in 1533 that Titian first painted the latter, and thenceforward he was constantly employed by the imperial family and court, for whom the important group of his works in the Prado (including *Danae*, *The Fall of Man*, and portraits of Charles V and Philip II) was painted. In 1545 he visited Rome, where he painted the group of Pope Paul III, the Cardinal Farnese, and Duke Ottavio Farnese.

His last period begins about 1555, and in one group of work (such as *Perseus and Andromeda* in the Wallace Collection) Titian recaptures the spirit of pagan poetry which fills his earlier work; while in another, represented by *Christ crowned with Thorns* (Munich), he displays a new depth and quality of emotion. In this period also he abandoned the use of rich local colour for a treatment in which it is modified by the play of light and shade and by atmosphere; and thus led the way to the use of chiaroscuro characteristic of the seventeenth century. Of Titian's private life but little is known. He died of the plague in 1576, aged ninety-nine, having painted to the last with almost undiminished powers.

Titica'ca, the largest freshwater lake of South America. It has an extreme length of 130 miles and a mean breadth of 44 miles; area, 3300 sq. miles, or a little less than half the area of Wales. One half is in Peru, the other in Bolivia. It has an altitude of 12,600 feet, and drains by the Desaguadero into the salt lake of Poopo or Aullagas, in Bolivia. At one time it was of much greater area and drained to the Amazon basin. See *Bolivia*; *Peru* (*Transport* section).

Title-deeds, in law, are the documentary evidences of ownership of real property. It is a felony for any person to destroy, obliterate, cancel, or alter any document of title to land with any fraudulent intent.

Titmouse, Tit, or Tomtit, the name given to a number of perching birds inhabiting most parts of the world, and constituting the family Paridæ. They are very active little birds, continually flitting from branch to branch, devouring seeds and insects, and not sparing even small birds when they happen to find them sick and are able to put an end to them. Their notes are shrill and wild. They build in the hollows of trees, in walls, &c. The great titmouse (*Parus major*) is between ·5 and 6 inches long, and inhabits Britain and Europe generally. Other British species are the blue titmouse (*P. cærulĕus*), the coal-tit (*P. ater*), the marsh-tit (*P. palustris*), and the long-tailed tit (*Acredula caudata*). The crested titmouse (*P. cristātus*) is comparatively rare in England, but common on the Continent, as is the so-called bearded titmouse (*Panurus biarmicus*), more properly termed the bearded reedling, and belonging to another family (Panuridæ). Several species are North American, some of them known as *chickadee* (q.v.).

Titration, a method adopted in chemical analysis. It consists in running a solution of known strength from a burette into a given volume of a solution of the substance to be analysed. The completion of the reaction between the two solutions is determined usually by a change of colour, often of a third substance, e.g. litmus, which is termed an indicator. The quantity taken from the burette being known, the chemical information desired can be obtained.

Titus, or, in full, Titus Flavius Sabinus Vespasianus, Roman emperor, born A.D. 40, died 81. The eldest son of the Emperor Vespasian, he served with credit as a military tribune in Germany and Britain, and accompanied his father in the war against the Jews as commander of a legion. When Vespasian became emperor (69) Titus was left to conduct the war in Judæa. He took Jerusalem (A.D. 70), and after visiting Egypt returned to Rome in triumph, and was associated with his father in the government of the empire. He became sole emperor in 79, and showed himself as an enlightened and munificent ruler, distinguished by benevolence and philanthropy. His brother Domitian was strongly suspected of having poisoned him.

Titus, in the New Testament, is the name of a young pagan convert to Christianity, of whose birth, home, and conversion nothing is known. He suddenly appears in the controversy over circumcision between the two parties in the primitive Church. Paul took him to Jerusalem as an object-lesson, to clinch the argument that Gentile Christians did not require to be circumcised in order to enter the Church of Christ. After this stormy scene, Titus appears in Paul's company as one of the evangelists and missionaries. He proved an energetic and reliable deputy, especially in connection with the Achaian Christians, and was employed in raising funds at Corinth for the Jewish Christian poor, a task which he accomplished with success. The only other incident in his life is a subsequent mission to the Island of Crete, where, as the *Epistle to Titus* implies, he was in charge of the local churches. Paul had left him to superintend affairs in that island, where the Church was in some disorder. When his mission to Dalmatia (*2 Tim.* iv, 10) occurred, we do not know. He was evidently a man of organizing ability, one of Paul's younger colleagues, perhaps one of his converts (*Titus*, i, 4), who served the interests of the mission loyally. Titus is never mentioned in the *Acts of the Apostles*; all that is known of him has to be inferred from the allusions in Paul's epistles (*2 Cor.* ii, 13; vii, 6, 13–14; viii, 6, 16, 23; xii, 18; *Gal.* ii, 1–3, and the *Epistle to Titus*). In later traditions he was regarded as living a celibate life in Crete, dying as an aged bishop. For centuries his name was one of the glories claimed by Crete, especially in its conflicts with Venice.

Titus, Epistle to, one of the three pastoral epistles of the New Testament (the remaining two being those addressed to Timothy), believed to have been written by St. Paul after his first imprisonment at Rome. The topics handled are the same which we find in the other two kindred epistles. See *Timothy, Epistles to.*

Tiv'erton, a municipal borough of Devonshire, England, at the confluence of the Loman and Exe Rivers. Lace and flour are made, with some beer. Pop. (1921), 9715.

Tiv'oli (ancient **Tibur**), a city of Rome, Central Italy, on the Teverone (or Anio), which here forms fine falls, having a drop of over 300 feet, and supplying power for the electric lighting of the city. Among ancient remains are the circular temple of the Sibyl and the ruins of Hadrian's villa. Pop. 10,000.

Tlaxca'la, a state of Mexico, an enclave of Puebla and Mexico states. It is very mountainous; area, 1584 sq. miles; pop. (1912), 186,642.

Tlaxcala, a town of Mexico, capital of the state of Tlaxcala; served by rail from Mexico City. It was an Indian capital of Mexico. Trade is in agricultural produce. Altitude, 8000 feet; pop. 3000.

Tlemcen, a town of Algeria, in the province of Oran, on the Moroccan Railway. It stands in the midst of olive groves, vineyards, and orchards, and was once a Moorish capital city. Pop. (1921), 43,090.

Toad, the name applied to various genera of tailless amphibians. Toads have a thick bulky body, covered with warts or papillæ. They have no teeth, and the tongue is fixed to the front of the mouth, but the posterior extremity is free and protrusible. The hind feet are but slightly webbed. They leap badly, and generally avoid the water, except in the breeding season. Their food consists of insects and worms. Toads have a most unprepossessing aspect and outward appearance. The common toad of Europe (*Bufo vulgāris*) was formerly considered dangerously poisonous, and, though it is innocuous to human beings, its skin secretes a poison which serves as a defence. Besides the common toad, the natterjack (*B. calamita*) is the only British species (see *Natterjack*). The toad is easily tamed, and exhibits a considerable amount of intelligence as a pet. It lies torpid in some hole during winter. Insects are caught by a sudden protrusion of the tongue, which is provided with a viscous secretion. There are some ten species of toads in North America. The Surinam toad is described in the article *Pipa*. The toad is extremely tenacious of life, but experiments have conclusively shown that there is no truth in the oft-repeated stories of the creature being able to support life when enclosed in solid rock for immense periods of time. Dr. Buckland has shown that when excluded from air and food, frogs and toads, in virtue of their slow circulation and cold-blooded habits, might survive about a year or eighteen months at most.

Toad-flax, the English name of various plants of the genus Linaria, order Scrophulariaceæ. The common toad-flax is *L. vulgāris*, which in its general habits is not unlike flax. The flowers are of a bright yellow; the corolla labiate, resembling that of snapdragon in shape, but provided with a long spur. It grows in hedges and fields, and is a reputed purgative and diuretic. The ivy-leaved toad-flax (*L. Cymbalaria*) is often found trailing over old walls. Allied to this genus is the Antirrhinum (q.v.).

Toad-flax (*Linaria vulgāris*)

Tobacco, the name of several species of Nicotiana (nat. ord. Solanaceæ), the leaves of which are variously prepared. They are manufactured in various forms, such as cigars, cigarettes, chewing and smoking tobacco, and snuff, collectively also known as tobacco, and have, when used in moderation, a sedative effect on the nervous system. The consumer, however, readily becomes addicted to tobacco, which, when indulged in to excess, may be injurious to the nerves and constitution, owing to the nicotine contained in the leaf.

Botany: Cultivation and Preparation. — The tobacco plant is an annual. It has a single stem from which the leaves sprout, and which terminates in a pinnacle of flowers. It is grown from seed. The seeds are exceedingly small, about 400,000 going to the ounce. Mixed with sand or fine ashes, the seeds are planted in spring in specially prepared nursery-beds of rich soil, exposed to sunlight, the beds being open or covered with glass or canvas, according to the climate. After six to eight weeks, the plants are transplanted to the open and set in straight rows, 1 to 3 feet apart, according to the type of tobacco and to local custom.

The mature plant, of *N. tabacum*, the Virginia type of tobacco, a native of Central or South America, attains a height of over 6 feet and bears pink flowers. The plant has alternate simple oblong lanceolate leaves, attaining 2 feet in length. Another species, *N. rustica*, has greenish-yellow flowers, with a shorter tube, while the plants as well as the leaves are smaller. Besides these there are about fifty other species.

Tobacco Plant, Leaves and Flowers

In order to obtain leaves of the desired quality or size, the flowers are cut out of the plants (topping), and only a few plants are allowed to develop seeds. The plants mature in about sixty days after leaving the nursery-beds. The lower leaves turn yellow and ripen first. In some countries these are collected before the rest of the plant ripens. They are of a different character (lighter and less gummy) than the other leaves of the same plant, and hence serve different purposes.

While in some countries all the leaves are picked off the stem in the field, in the case of most American tobaccos the whole plant is cut, and the leaves are taken off after the plants have wilted. Thus the leaf becomes gummier because of the juices which pass into it from the wilting stem. In various countries the wilted leaves are tied into bundles (hands) by means of inferior tobacco leaves or dried grasses, or they are strung on strings. In any case, they are hung up in barns and dried.

When dry, the tobacco is massed in piles and allowed to lie. It then ferments, and the fermentation produces heat. The temperature of the piles is carefully observed by means of thermometers, since over-heating leads to damage by over-fermentation. The fermentation may be stopped by taking down the piles and spreading the leaves. The piles are occasionally rearranged so as to put the outside leaves inside, where the strongest fermentation takes place. The object of fermentation is to affect the colour and the flavour (ripening, curing), and to make the tobacco keep. Tobacco, once properly fermented, can be packed in bales, cases, or hogsheads[1] for transportation and storage, and can be preserved for many years without deteriorating. In fact, since most tobaccos undergo renewed fermentation in summer heat, their quality improves through ageing; but bright colours are apt to grow darker. Some varieties, therefore, such as bright Virginia, North Carolina, and Burley tobaccos, are exposed to steam heat (steam dried) before packing, in order to ensure the proper preservation of the tobaccos and particularly of their bright (yellow or light-brown) colour. Since fermentation has the added effect of rendering the leaves supple, the packing into bales, cases, or hogsheads is sometimes done immediately after fermentation. In other instances the leaves are exposed to steam, or merely to the dampness of the atmosphere, before being packed. The packing is done under pressure, sometimes even hydraulic, so that the leaves in the packages are often considerably twisted and intertwined.

Manufacture.—Practically every process of the manufacture of tobacco is begun by applying water or steam to the tobacco leaves as taken from the packages, which renders them as supple as chamois skin, since leaf tobacco readily absorbs moisture from the atmosphere; in some cases it is merely exposed to damp air in order to render it pliant. In this state the leaves which were mixed and wrinkled in the packages can be unfolded and manipulated without breaking.

Smoking-tobacco.—After different varieties of leaves have been mixed and sometimes sprinkled with flavourings, as, for example, liquorice or fruit extracts, they are cut by machine into narrow strips or small flakes. In some cases the midribs of the leaves are previously removed (stripped or stemmed). Some cut tobaccos are roasted in drums. Another way of making smoking-tobacco is by breaking dried leaves into small particles (granulating). The simplest way to make smoking-tobacco, which is adopted by many tobacco-growers, is merely to rub dried leaves to pieces in the hand. The packing of smoking-tobacco into tins or retail packages is done by machine.

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[1] The weight of bales varies, according to local usage, from about 20 lb. to over 300 lb.; cases weigh approximately 350 lb. net, while hogsheads vary from approximately 500 to 2000 lb. net.

Rolled or Spun Tobacco.—In some countries fat juicy leaves are thoroughly soaked or boiled in sweet flavourings, and are, by mechanical means, twisted or spun into ropes, pieces of which are twisted into small coils and dried. In other countries heavily flavoured and sweetened leaves of a spongy texture are rolled up and hydraulically pressed and dried (plug). In other countries, again, tobacco leaves of tough texture are sliced into strips as for smoking-tobacco, and thus sold for chewing purposes. This tobacco, after being chewed, is often dried by the consumer and smoked in his pipe.

Snuff.—Thick, fleshy dark leaves are most suitable, and after being treated with liquorice, tonka beans, or other flavouring matter are moistened and heaped up for several weeks, in order to ferment strongly. The leaves are dried, ground, and repeatedly fermented anew. The product (snuff) is a very fine black, brown, or light-grey powder. Snuff is mostly applied to the nostrils, but sometimes to the gums.

Cigars.—A cigar is composed of three parts, the filler, the binder, and the wrapper. The filler is usually an admixture of small pieces of leaves of various kinds of tobacco, the midribs of which have been removed, after slightly moistening the leaves. The breaking up of the leaves is mostly done by hand, sometimes by machine. A handful of filler is pressed by the fingers into a cylindrical mass and rolled with the palm of the hand (sometimes with the flat side of a special half-moon shaped implement) on a board of about 1 foot square lying on the working table into a piece of moist and pliable stripped leaf, called the binder. This half-product (bunch) is now enveloped by a narrow strip cut out of a stemmed leaf of a particular colour and texture (the wrapper), into which it is rolled on the bias, also by hand. The wrapper covers the cigar in spiral fashion, and is kept from unrolling by being pasted at the pointed end of the cigar. At the other end unevennesses are trimmed off. In some countries these trimmings and the waste that falls off the leaves from which the wrappers and binders are cut are packed in bales or cases, and are an article of—even international—trade (cuttings). It is a general but erroneous idea that cigars of light colour are milder than dark cigars. The mere fact that the wrapper constitutes only a very small percentage of the tobacco contained in a cigar goes to prove that its effect is insignificant compared with the effect of the qualities of the filler, the colour of which is hidden from sight. There are machines for making bunches and also for cutting and rolling wrappers, but the delicate touch of the hand of the experienced cigar-maker cannot thus be replaced. A wooden mould in which the bunch is pressed and dried, so as to give it the desired shape, is largely used, but the difference from the entirely hand-made product is noticeable to the connoisseur. While some imported Havana, Brazil, or Manila cigars are made from one variety of tobacco throughout, cigars manufactured in Britain are mostly made of several varieties properly blended. Sometimes the tobacco for cigars is artificially flavoured.

Cheroots, cigarillos, and *stogies* are thin cigars of cylindrical form, often made without binders. They frequently have a coarse appearance, as a particular attraction to the smoker.

Cigarettes consist of thin rolls of shredded tobacco wrapped in thin white paper. While in the Latin countries cigarettes are made of what is termed cigar-tobaccos, elsewhere particular varieties of yellow and light-coloured (preferably Turkish) tobaccos are used, the leaves of which often measure not more than 2 inches in length when mature. Cigarette tobaccos are sometimes flavoured (sweetened), while the addition of opium also occurs.

Originally the smoker rolled his cigarette himself between his finger-tips, or stuffed the tobacco into small tissue-paper tubes bought for the purpose. Cigarettes are now largely made by automatic machines, which roll the shredded tobacco into a long rope. This rope, while gliding forward, meets a narrow tape of thin paper which is being unrolled from a coil and which travels at the same speed in the same direction, and which, while enveloping the rope of tobacco, is fastened around it (glued or crimped). The machine cuts this endless cigarette into small bits of the required size; it prints the name of the brand and its maker on the paper, it gilds the tips or puts cork on them as required, and is perhaps one of the most ingenious machines in existence, covering, as it does, an entire process of manufacture, including the packing for retail. Some of these cigarette-machines turn out tens of thousands of cigarettes per hour.

By-products and Half-products.—Among these are the midribs, stripped from the leaves (English stalks, American stems). They are soaked, rolled flat, and used as a substitute for common grades of leaves, in practically all varieties of tobacco products. Many manufacturers do not utilize the stalks of their tobacco, but sell them for international trade. Tobaccos destined for British manufacture are often stripped abroad for economic reasons in connection with duties. The stemless leaves (strips) are packed tangled or tied flat in bundles (books), as the case may be, and shipped to England. Extracts and juices are made of the heavier and most juicy varieties of leaf and stalk, and used for flavouring the products of other tobaccos, for washing sheep, as insecticides, and for chemical purposes. The pulp is used as manure.

Chemistry.—Products of the analysis of tobacco are water, ash, nicotine, nitric anhydride (N_2O_5), ammonia (NH_3), fibre, starch, nitrogen free extract, and ether extract. Their relative quantities vary not only in different varieties of tobacco, but also in the fermented and unfermented states of the same variety. Hence it lies beyond the scope of this article to attempt a tabulation. It may suffice to state that *nicotine* ($C_{10}H_{14}N_2$), a volatile alkaloid, appears to be present only in plants of the genus Nicotiana.

Markets, Prices, Taxation, Trade.—In localities where tobacco is grown there are markets to which the planters, in so far as they do not pack their product themselves, bring it, and where it is sold (frequently by auction) to merchants who specialize in fermenting, assorting, and packing tobacco into the packages in which it is handled in trade, and in selling it from these local markets. Among these markets are Lexington and Louisville, Kentucky; Clarksville, Tennessee; Danville, Virginia; Hartford, Connecticut; Lancaster, Pennsylvania; Canton and Shanghai, China; Madras and Calcutta, British India; Smyrna, Samsun, and Trebizond, Turkey; Kavala and Nauplia, Greece; Sofia, Bulgaria; Algiers and Bône, Algeria. Colonial tobacco is packed on the plantations and shipped to the mother country, where it enters the world trade—London for British North Borneo, African, and other tobaccos (private sales); Amsterdam and Rotterdam for Java and Sumatra tobacco (sales by tender). The chief world markets for the general leaf-tobacco trade are, in alphabetic order: Amsterdam, Antwerp, Bremen, Dresden (cigarette tobaccos only), Hamburg, Liverpool, London, New York, Rotterdam. In these cities manufacturers from various countries find among the stock of tobacco merchants leaf tobacco from practically every part of the world, so that by comparison of the qualities and merits of the various varieties of tobacco leaf a world market value originates for each. The high duties on leaf tobacco, and the restrictions which these necessarily impose on the leaf-tobacco trade, without doubt prevent Great Britain and the United States from developing the leading tobacco markets of the world.

Tobacco is now grown in almost every country. Of over 1,000,000 tons raised in 1906, about 300,000 tons were raised in the United States and 250,000 tons in British India. Then follow Russia, with 80,000 tons; Austria-Hungary and the Dutch East Indies, each with approximately 60,000 tons; Japan and Turkey, each with 38,000 tons; Germany and Brazil, each with 27,000 tons; France and Cuba, each with 18,000 tons. From 10 to 1000 tons each were raised in Argentina, the Philippines, Mexico, Belgium, Ecuador, South Africa, Italy, Algeria, Bulgaria, Colombia, Porto Rico, Paraguay. Less than 1000 tons were raised in Serbia, the Netherlands, Australia, Sweden, Montenegro, Denmark. These statistics do not claim to be complete, since China, for example, is not mentioned, which raises considerable but unknown quantities of tobacco, partly for export.

IMPORTS INTO GREAT BRITAIN, 1921

Country of Origin.	Lb.	Value (£).
Unmanufactured ..	*227,837,184*	*22,213,196*
United States	214,756,664	20,789,839
India	1,415,162	46,562
Greece	1,144,593	249,803
Russia	776,164	57,775
Turkey	55,085	14,583
Manufactured	*1,274,989*	*622,061*
Cuba—cigars	211,373	366,189
United States—cigarettes	38,678	12,692
Egypt—cigarettes ..	105,231	54,865
Canada—cigarettes ..	16,417	4,556

BRITISH CUSTOMS RECEIPTS

1919	£46,231,430	1913 .. £17,254,125.
1920	60,944,865	
1921	55,606,342	
1922	55,277,907	

In 1910 the world's production of tobacco was 2,756,000,000 lb., the leading producers being: United States, 1,113,400,000 lb.; India, 450,000,000; Russia, 200,000,000; Austria-Hungary, 184,000,000; Dutch East Indies, 128,600,000; and Japan, 93,000,000.

Duty.—On unmanufactured tobacco containing 10 per cent or more of moisture the duty (1923) is: stripped and stemmed, 8*s.* 2½*d.* per lb.; unstripped, 8*s.* 2*d.* per lb.; a preference equal to five-sixths of the maximum rate being accorded to Imperial produce. Where less than 10 per cent moisture is contained, 9*s.* 1*d.* per lb. stripped, and 9*s.* 0½*d.* unstripped is levied. On manufactured tobaccos and snuffs the duty is much higher, reaching 15*s.* 7*d.* per lb. on cigars.

The trade in and appraising of leaf tobacco requires expert judgment, since no quotations or classifications can give guidance to the outsider as to the peculiar qualities of various grades. Although it is impossible to give an adequate idea of the various points by which tobaccos are appraised, one may say, in general, that the size and shape of the leaf, its texture, colour, specific weight, combustibility and the colour of its ashes (white preferred), its aroma, its taste and the taste and smell of its smoke are all factors in its appreciation. While the appreciation varies according to the taste of the individual and to local and national preferences in general, the colours preferred for cigarette and smoking-tobacco range from canary-yellow, light-brown, dark-brown, to almost black, while cigar tobaccos are generally brown, though mouse-grey is at present a fashionable colour for cigar wrappers. The valuation of the leaf by individual manufacturers is greatly influenced by the taste of their customers, which varies greatly according to locality (climate) and nationality, by the duties imposed on leaf tobacco in their countries, and by the dexterity of their working staff.

In most countries excises are imposed on domestic manufactures and duties raised on imported manufactures and on leaf tobacco. In some countries, such as France, Italy, Morocco, Spain, Sweden, Austria, and Czecho-Slovakia, the Government monopolizes the manufacture and sale of tobacco products, but sometimes leases its rights. Since different grades and varieties of tobacco are required for different products, and since different countries grow widely varying styles of tobacco (even slight variations in climate or soil bringing about great differences in plants of the same variety, practically no two countries producing identical tobaccos), almost none grow all the varieties they require. Hence most producing countries, though they export large quantities of home-grown tobacco (e.g. the United States), nevertheless import foreign leaf tobacco.

Toba'go, an island of the British West Indies, a political dependency of Trinidad, 24 miles south-west; area, 114 sq. miles. It is of volcanic formation, comprising a dorsal ridge, 18 miles long and 1800 feet altitude, surmounted by conical hills. Cocoa, coco-nuts, and copra, with some vegetables, poultry, eggs, fruit, and live-stock are the chief exports. There are seven parishes: St. Patrick, St. Andrew, St. David, St. George, St. John, St. Paul, and St. Mary. Scarborough (pop. 729) is the chief town. Tobago was discovered by Columbus in 1498, and was definitely ceded to Great Britain by France in 1814. Pop. 23,380.

Tobermory, a seaport of Argyllshire, Scotland, in the Island of Mull. One of the ships of the Spanish Armada was blown up in the bay in 1588. After several unsuccessful attempts to recover treasure, Colonel Foss commenced operations in 1912, and recovered many valuable relics. Further salvage operations were conducted in late years. Pop. 997.

Tobit, Book of, one of the Old Testament apocryphal books, rejected by the Jews and Protestants, but included in the Roman Catholic canon. It contains an account of some remarkable events in the life of Tobit, a Jew of the tribe of Naphtali, carried captive to Nineveh, and his son Tobias. The book bears a strong likeness to the tales of *The Thousand and One Nights*, with the obvious exception that the writer has a considerable acquaintance and sympathy with the Old Testament writings.

Tobogganing, a winter sport popular in Canada, the United States, and Switzerland. The toboggan (Micmac Indian, *tobaakan*) is a light sled mounted on steel or steel-shod runners; it carries a single passenger, who lies on it face downwards, steering with his toes. In Switzerland, where Symonds did much to popularize the sport, the most famous ‘ run ’ is that of the Cresta, St. Moritz, 1400 yards in length, with a drop of 500 feet, and a wide variety of curves and gradients. Here the Grand National competition, open to the world, takes place. Another well-known course is that upon the Klosters-Davos road, 2 miles long, 800 feet fall, on which the International and Symonds Shield competitions are held. The negotiation of corners at high speed demands much skill, for a pace of 70 miles an hour is at times attained. The bob-sleigh is a toboggan for two or more passengers.—Cf. *Ice Sports* (Isthmian Library).

Tobol, a river of Siberia, which rises in the Ural Mountains and joins the Irtysh after a course of about 550 miles.

Tobolsk', a former government of Western Siberia, drained by the Ob and Irtysh Rivers, and producing gold, coal, saltpetre, live-stock, wheat, and rye. Tobolsk is the capital. Area, 540,000 sq. miles; pop. 2,000,000.

Tobolsk, capital of the government of Tobolsk, Western Siberia, on the Tobol where it joins the Irtysh. Fighting took place at Tobolsk in 1919 between Koltchak's forces and the Bolsheviki. After the Revolution of 1917, the ex-Tsar Nicholas II was imprisoned in the town. Pop. 25,000.

Tocantins', a river of Brazil, which rises in lat. 14° s., flows northward, receives the Araguay, and enters the Atlantic by the Pará estuary, forming one mouth of the Amazon. The entire course is 1600 miles, but navigation is impeded in parts.

Tocqueville (tok-vēl), Alexis Charles Henri Clérel de, French politician and writer, born in 1805, died in 1859. His chief work was *La Démocratie en Amérique* (1834), which was translated into the principal European languages. In 1849 he accepted the portfolio of foreign affairs, but soon resigned it. After the *coup d'état* of 1851 he lived in retirement. His other works include *L'Ancien Régime et la Révolution* and *Histoire philosophique du règne de Louis XV*.

Todas, a race inhabiting the upper part of the Nilghiri Hills of Southern India, considered to be of Dravidian stock. They form a typical polyandrous community (about 750 in number), in which a woman is the wife of her husband's brothers.

Todea, a small genus of Ferns, family Osmundaceæ, natives of the southern hemisphere. Some species are 'filmy ferns'.

Tod'hunter, Isaac, British mathematician, born at Rye in 1820, died in 1884. He studied at University College, London, and afterwards graduated as senior wrangler from St. John's College, Cambridge, where he resided as Fellow, tutor, and principal mathematical lecturer until his death. He wrote a series of popular mathematical textbooks, and valuable histories of certain special branches of mathematics and mathematical physics, including probability, the calculus of variations, attraction, and elasticity.

Todleben (tod'lā-bĕn), Franz Eduard Ivanovitsh, Count, Russian soldier and military engineer, born 1818, died 1884. Entering the Russian army (1836), he served against the Circassians (1848), took the chief part in the defence of Sebastopol (1854), and, after the peace of 1856, wrote his monumental *Défense de Sévastopol.* During the Russo-Turkish War, Todleben was sent (1877) to reduce Plevna, was created count, and subsequently became Commander-in-Chief of the Russian army in Turkey. He was appointed Governor of Odessa (1879) and (1880) of Vilna.

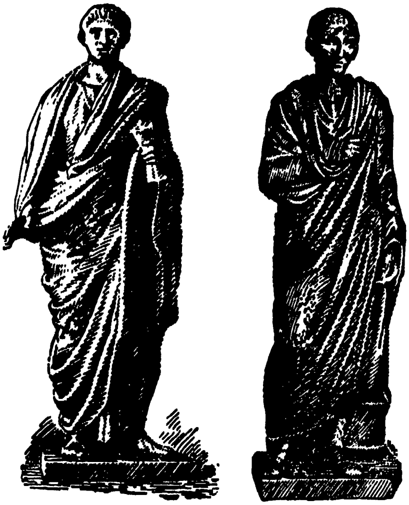
Todmor'den, a municipal borough and market town of England, in Yorkshire (West Riding), on the Calder. It has extensive manufactures of cotton goods. Pop. (1921), 23,888.

Tody, the name of certain tropical birds, genus Todus, sub-family Todinæ, family Momotidæ, inhabiting the larger islands of the West Indies. They are birds of gaudy plumage, and feed on insects, worms, &c. The best-known species is the green tody (*T. viridis*), a pretty bird, about the size of a wren. It is very common in Jamaica.

Toga (Lat. *tegere*, to cover), the principal outer garment of wool worn by Roman citizens. It covered the whole of the body except the right arm, and it was originally worn by both sexes until the matrons adopted the *stola.* The *toga virilis*, or manly gown, was assumed by Roman youths when they attained the age of puberty. The variety in the colour, the fineness of the wool, and the ornaments attached to it indicated the rank of the citizen; generally it was white. Under the emperors the toga went out of fashion, giving place to lighter and more convenient garments of foreign origin.

Togo, Heihachiro, Count, Japanese Admiral, born 1847, a Satsuma Samurai; educated, H.M.S. *Worcester* and at the Naval College, Greenwich (1873–4). During the Chino-Japanese War he had a command, and was Commander-in-Chief of the Japanese fleet during the Russo-Japanese War (1904–5), his most brilliant action being Tsushima. Togo became a member of the Order of Merit in 1906, and is one of the three honorary members, Foch and Joffre being the other two.

Togoland, a former German West-African colony divided after the European War between Great Britain and France. *Physical.*—Togoland is divided into a transmontane and a cismontane region by a hill-range (Mount Agu, 3370 feet) built up of quartzites and mica-schists, and trending north-east to south-west. It has various names in different districts. The transmontane district is the larger, and comprises mainly the valley of the Oti, through which it is drained to the Volta (q.v.), being separated by the Gambaga Hills from a narrow frontier tract which belongs physically to the Gourma Plateau. South-east of the hills the region becomes narrower, and the seaboard on the Slave Coast (Bight of Benin) is only 32 miles long. There is a coastal plain fringed by a broad bank of yellow sand, formed by the scouring of a powerful coastal current (the Kalema) which manifests itself in the heavy breakers beating upon the shore, and which has dammed up and is gradually filling a series of lagoons. Of these lagoons the largest is the Togo or Avon (Ger. *Togo See*), into which fall the Rivers Haho and Schio, and upon which stands Togo town. The alluvium deposited by



Two Modes of wearing the Toga. From ancient Roman statues the rivers is also gradually filling up the lagoons. Togo Lagoon is drained to the mouth of the Monu River by the Wo and Anecho (or Popo) Lagoons and a channel running behind the sand-bank. Behind the coastal plain a savanna extends for 50 miles, and is separated by a depression from the plateau of the interior, which rises inland to an altitude of over 1400 feet. *Climate and Health.*—Togoland has a humid tropical climate, and it is not a white man's country. A large southern and south-central zone is dominated by the tsetse fly, and malaria is prevalent. In the dry months and in the north of the country cerebro-spinal meningitis is common, as are dysentery, smallpox, leprosy, skin diseases, and sleeping-sickness in the south. Goitre and tuberculosis are fairly common, and there are many endemic diseases unknown to European medicine. There are two rainy seasons in the south, viz. March–June and September–November, and in the north only one, April–October. February and March are the hottest months, the coastal temperature then averaging 80° F., and the highlands (at Bismarckburg, one of the healthiest places) 79° F. July and August are the coldest months, with a mean temperature of 74° F. on the coast and 70° F. at Bismarckburg. From December to February the Harmattan (q.v.) blows. Frequent droughts are caused by the drying up of rivers, none of which may be considered perennial, unless in the highlands, where they always contain water, and where there are from 150 to 200 thunderstorms per annum.

Area, Towns, &c.—The total area of Togoland is 33,700 sq. miles (i.e. about the size of Portugal or Ireland), but it is partitioned between Britain and France, the former administering approximately 13,000 sq. miles with a population (1921) of 188,265. In 1921 the population of all Togoland was estimated at 672,837, 210 of whom were Europeans. German figures show that in 1914 there were 368 Europeans, 320 being German; and the native population was estimated at over a million. All figures, however, are to be accepted with caution. Besides Lome, towns located on the sand-spit are Anecho or Little Popo; Porto Seguro (pop. 1200), the port of Togo town; and Bagida. Sansane-Mangu (9000), Sokode (4000), Bassari (10,000), Yendi (10,000, a fairly healthy place), Bismarckburg (founded 1894 as a European station), Kete-Krachi (8–9000), Atakpame (10,000), Misahöhe (founded in 1890 as a Government station), Kpandu (3000) are other places.

Communications.—Lome (pop. 5800) is the chief port of the region and its natural outlet. Railways are of metre gauge, and have Lome as a nodal point, whence they run: (1) along the coast to Anecho, a distance of 27 miles; (2) to Palime (74 miles, pop. 1000: for Misahöhe); and (3) to Atakpame (102 miles).

Production.—The chief agricultural products are maize, sweet potatoes, dukhn (in the north), cotton (widely in the south), cane-sugar, durra (a native staple), rubber (wild and cultivated), some tobacco, ground nuts (the main product of the north), tea, coffee, piassava fibre, tapioca, sesame, rice, kola-nuts, pepper, yams, and many fruits, including pineapples. Among trees the chief are the coco-nut palm, the oil-palm, and the shea tree. Palm-oil and kernels from the second of these, and copra from the first named, are important articles of export, but are run closely by shea butter, a valuable commercial product used in the manufacture of candles, soap, and margarine. Horses do not thrive in Togoland, and mules do better. Goats and sheep are kept in large numbers. Among minerals, gold, bauxite (an ore of aluminium), chromite, and galena have been found; and numerous deposits of iron ore (hæmatite) exist at Banyeli, remote, however, from any organized system of transport, and therefore unworkable on a large scale.

History.—The Portuguese traded with the coast of Togoland during the fifteenth century, and to them the introduction of the coco-nut palm is usually ascribed. In 1680 the Elector of Brandenburg sent an expedition to Togo, where he secured a trading monopoly; but on his death all rights were surrendered to the Dutch for a cash payment (1718). On 5th July, 1884, Togoland was declared a protectorate of Germany, and the hinterland was rapidly and efficiently occupied and explored. Togoland was not only the first German imperial colony in Africa, but was also unique as self-supporting. In 1914 von Döring was Governor, and he did not expect that Great Britain would participate in the impending war, preparing himself for the invasion of Dahomey on this assumption. Anglo-French troops under the command of Captain F. C. Bryant invaded Togo, and after a brilliant little campaign trapped von Döring in Kamina, where he (with 205 Europeans) surrendered unconditionally on 26th Aug., 1914. On 7th May, 1919, the Supreme Council awarded the mandate for the administration of the territory to France and Great Britain, and it was partitioned accordingly.

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First List of Names in Gold Coast and British Togo.

Tokar, a town of Sudan, in the Red Sea Province. The district is a cotton-growing region. Pop. 20,000.—Another Tokar is a Hadendoa settlement in Kassala.

Tokat, a town of North-Eastern Anatolia. It has Roman remains, &c. Pop. about 30,000.

Tokay, a town of Hungary, at the conflux of the Rivers Theiss and Bodrog. The wine grown in its vicinity (Tokay) is noted. Pop. 5300.

Tokens, pieces of money current by sufferance, and not coined by authority; or coins only nominally of their professed value. In England tokens first came into use in the reign of Henry VIII, owing to the want of authorized coins of lower value than a penny. Stamped tokens of lead, tin, and even leather were issued by vintners, grocers, and other tradesmen during the time of Elizabeth, and were extensively circulated, being readily exchanged for authorized money at the shops where they were issued. A currency of this kind (mostly of copper) was much used in Britain towards the close of the eighteenth century.

Tokyo (formerly **Yedo**), the capital of the Japanese Empire and the seat of the Tennō (Emperor), on the Bay of Tokyo, Island of Honshu. It is divided by the River Sumida, and is the terminus of several railways. There is a *ceinture* as in Paris. The greater part of the town is flat, and intersected by numerous canals crossed by bridges. Tokyo may be considered the centre of the political and literary activity of Japan, and commercial interests are slowly developing. The university is of world importance There is an imperial palace, and a zoological garden is located in the Uyeno Park, where there is also an imperial museum. Pop. 2,173,180. During the terrible earthquake of 1st Sept., 1923, Tokyo was almost destroyed.

Toland, John, English deist, born in 1670, died in 1722. He entered Glasgow University in 1687, graduated M.A. at Edinburgh in 1690, and afterwards studied theology at Leiden. In 1696 he published his *Christianity not Mysterious*, which created a great sensation, and was burnt by the hangman at Dublin by order of the Irish Parliament in 1697. He subsequently settled down as a voluminous pamphleteer in London. Of his other works the chief were: *Life of Milton* (1698), accompanying an edition of his writings; *Anglia Libera* (1701); *Socinianism Truly Stated* (1705); and *Pantheisticon* (1750). In the last of these works Toland distinctly avowed himself a pantheist.

Tole'do, a province of Central Spain. It is mainly a high plateau cleft in the north-west by the high valley of the Tagus, to the basin of which it chiefly belongs. Agriculture is the chief occupation. Toledo is the capital. Area, 5919 sq. miles; pop. 450,544.

Toledo (ancient **Tolĕtum**), a city of Spain, capital of the province of Toledo, on the Tagus, and 1820 feet above sea-level; on the railway from Madrid. It is the see of an archbishop, who is Primate of Spain. It is one of the most interesting cities in Spain, and 'an epitome of its history'. Its chief glory is a Gothic cathedral, one of the grandest in the world, completed in 1492. The Toledo sword-blades, renowned for centuries, are manufactured (with cutlery in general) in a Government establishment. Toledo was taken by the Romans in 193 B.C., and was subsequently the seat of government under the Goths, Moors, and Kings of Castile in succession. Pop. 22,270.

Toledo, a city of Ohio, United States, the county seat of Lucas county, on Lake Erie; served by the Pennsylvania and other railways. Toledo is the terminus of the Miami and Erie, and the Wabash and Erie Canals, and exports flour, grain, cattle, beef, pork, hides, wool, tobacco, and timber. There are large wagon-works, machine-shops, foundries, flour-mills, and manufactories of tobacco, flax, cotton, and chandlery. Founded in 1833, it was incorporated as a city in 1836. Pop. (1920), 243,167.

Tolenti'no (ancient **Tolentinum Picenum**), a city of Marches, Central Italy, in the province of Macerata. Here Pope Pius VI, in 1797, concluded a humiliating peace with Bonaparte, and in the neighbourhood, in 1815, Murat, at the head of the Neapolitans, was defeated by the Austrians under Bianchi. Pop. (commune), 14,300.

Tolerance, in engineering, the amount of variation allowed from exact accordance with specified dimensions. The very idea of tolerance presupposes the existence of instruments capable of making measurements with precision, especially measurements of length. The simple method of placing a rule against an article and reading the scale has great limitations. The limit of precision possible in that way is about the nearest fiftieth or sixty-fourth of an inch. That method is too crude to use in measuring machine parts that are to work together with little or no vibration and noise. There are four usual types of fit used: *force*, requiring a screw or press; *drive*, with the use of a hammer; *push*, by hand pressure; and *running*, free enough to run almost indefinitely if lubricated. The *tolerance*, or range between the smallest and greatest allowable dimensions, varies in these four cases, and also proportionately to the size of the part. In small articles with fine quality of workmanship, limits of a few ten-thousandths of an inch are usual. The instruments of precision used must be of sufficient sturdiness to withstand the respectful but vigorous handling of a turner or machineman. Among such instruments vernier callipers, micrometer gauges, and limit gauges are the most common.

In *vernier callipers* (see *Vernier*) the main scale is divided into tenths and fortieths, while the vernier has twenty-five divisions. Readings can be made to one-twenty-fifth of a fortieth, that is, one-thousandth of an inch without the use of a lens.

Micrometer gauges have accurately cut screws, whose pitch is usually forty to the inch, and the fractions of a complete turn are measured with a circular scale on the thimble part of the gauge. The circular scale is divided into twenty-five parts, so that the fortieths obtained by complete turns of the screw can be subdivided into thousandths. These gauges are provided with the means of adjustment for wear, and a racket stop whose function is to ensure that the same pressures are applied to the articles measured, no matter how roughly it is turned. Similar micrometer fittings are used in depth, straight, internal, and other gauges.

Limit gauges are made or set to the dimensions which are in use for the maximum and minimum sizes. Limit sizes have been standardized by gauge-makers and by the British Engineering Standards Committee. As an example, a 3-inch diameter shaft which is to be made a running fit of first quality work must have a diameter between 2·9982 and 3·0000 inches. When much work of this character is done, limit gauges are made to these limiting dimensions, to take the place of micrometer gauges. The shaft itself must be of a size between the limits, that is, when the gauge test is made the one gap can 'go', but the other will 'not go' over the diameter. Plug gauges of 3·0018 and 3·0035 inches diameter would be used as the 'go' and 'not go' gauges to test the dimensions of the hole in which the shaft is to be a running fit. The adjustable gauges have two fixed points on one end, and two adjustable screwed points at the other. These points are set by means of reference bars.

Tolima (tō-lē′mȧ), a state of the Republic of Colombia, traversed by the Upper Magdalena, and embraced between the two chief chains of the Cordillera; area, 10,080 sq. miles. It produces cacao, sugar, maize, and tobacco, and is rich in gold, silver, lead, sulphur, and copper. The volcano of Tolima has a height of 18,300 feet. Pop. (1918), 328,812. Capital, Ibagué.

Toll, a tax paid, or duty imposed, for some liberty or privilege or other reasonable consideration; such as (*a*) the payment claimed by the owners of a port for goods landed or shipped there; (*b*) the sum charged by the owners of a market or fair for goods brought to be sold there; (*c*) a fixed charge made by those entrusted with the maintenance of roads, streets, bridges, &c., for the passage of persons, goods, and cattle.

Tolmiæa, a genus of plants, order Saxifragaceæ. *T. Menziesii* is a pretty foliage plant often grown in pots. It propagates itself freely from adventitious buds borne at the base of each leaf; hence the popular name 'mother-of-millions'.

Tolstoy, Count Leo Nicolaevitsh, Russian novelist, religious teacher, and social reformer, born at Yasnaya Polyana, in the government of Tula, 1828, died 1910. He received his earlier education at home, and from 1843 to 1846 studied Oriental languages and law at the University of Kazan. In 1851 he went to the Caucasus, and served in the defence of Sebastopol during the Crimean War. To this period of his career belong his earliest literary works: *Childhood, Boyhood,* and *Youth,* and the brilliant descriptions of the Crimean campaign, entitled *Sebastopol.* On the conclusion of the war he went to St. Petersburg (Petrograd), where he published *The Snowstorm* and *Two Hussars.* In 1857 he travelled abroad, and on his return he retired to his estate to live a simpler life. Greatly interested in the condition of the peasantry, he founded a free village school on his estate, for which he prepared reading and other textbooks himself. His work *Family Happiness* appeared in 1859, and was soon followed by *Three Deaths* (1859), *Polikushka* (1860), and others. In 1862 he married the daughter of a Moscow physician, and during the next period of his life he produced the two works upon which his literary reputation chiefly rests, namely, *War and Peace* (1865–8) and *Anna Karenina* (1877), a powerfully realistic study of human passion and its effects. *Anna Karenina,* wherein the author depicts the clash between passion and inner duty, marks a transition to the third period of Tolstoy's life, during which he began to develop his views on religion and its application to individual and social life. He began to search for the sense and meaning of life. He turned to science and philosophy, asking them to solve the riddle of life; but both science and philosophy failed to answer his questions, and he at last turned to religion. He proclaimed the utter bankruptcy of science, of philosophy, and progress, and came to the conclusion that faith alone could give happiness. Tolstoy then confessed his sins and turned Christian, but he soon freed himself from the Established Church, and worked out his own ideas of Christianity. In the Gospels he found the fundamental principle for a basis of life. He found it in the Sermon on the Mount, and in the five commandments of Jesus (*Matt.* v, vi, vii). Tolstoy's religious, social, and moral ideas may be summed up as follows: In religion we must not resist evil, for the law of the Gospel is the law of peace. Politically the doctrine of Christ admits of neither states, nor armies, nor tribunals. Socially it means the suppression of property and the proclamation of communism. His social ideal is thus based upon complete renunciation, his moral ideal upon complete purity and chastity. All our social institutions, therefore, which are based upon a state of war and violence must be abolished, not by means of revolutions, but by passive non-resistance. Practically, Tolstoy had arrived at the same conclusions as Prince Kropotkin, but whilst the latter had appealed to revolt, Tolstoy, who believed in the original goodness of man, preached the gospel of non-resistance, of intellectual, passive anarchy. His whole teaching was therefore a religion of Love and Labour, and he was right when he wrote that "there is no Tolstoism and never will be; all that I have said has already been said eighteen centuries ago, and much better, in the Gospels". Having arrived at these conclusions, Tolstoy endeavoured to put his theories into practice. He wished to distribute all his wealth, but his wife and family opposed his plan, and he was compelled to remain a rich man. During the last year of his life he made an effort to leave his comfortable home and to disappear among the peasants. He actually left his home, but fell ill and died shortly afterwards. Even those who do not agree with Tolstoy the moralist and social reformer, cannot help admiring Tolstoy the artist and novelist. He is a wonderful painter and an observer of human life. He had a power of psychological analysis, and his works have a Biblical directness and simplicity. The principal works containing Tolstoy's moral, social, and religious teaching are: *My Confession*, *The Four Gospels Harmonized and Translated*, *What I Believe*, *The Power of Darkness*, *The Kreutzer Sonata*, *The Kingdom of God is Within You*, and *Resurrection*.—BIBLIOGRAPHY: A. Maude, *L. Tolstoy*; E. Garnett, *Tolstoy: his Life and Writings*; A. S. Rappoport, *Tolstoy: his Life, Works, and Doctrine*.

Tolu-balsam, a resin or balsam obtained from a tree of tropical South America, the *Myrospermum* (*Myroxylon*) *toluiferum* or *peruiferum*. Tolu-balsam has a brownish-yellow colour, becomes quite hard and may be formed into a powder, has a pleasant aromatic flavour, and is used in certain medicinal preparations, though it has little or no virtue of its own.

Tolu'ca, a city of Mexico, capital of the state of Mexico, situated 8500 feet above the sea, and served by the National railways. The city has a cathedral, a theatre, &c., and carries on cotton manufacture and other industries. Pop. 31,500.

Toluene, toluol, or methylbenzene, $C_6H_5CH_3$, a hydrocarbon belonging to the same homologous series as benzene, and having the same general properties. It is a colourless liquid boiling at 110° C., obtained by the fractional distillation of coal-tar, from tolu-balsam, and synthetically. It is used in the preparation of explosives, and of benzaldehyde and other substances important in the dye-making industry.

Tomahawk, the light battle-axe of the North American Indians. The head was originally of stone attached to the shaft by thongs, &c., but steel heads were subsequently supplied by American and European traders. The Indians could throw the tomahawk to a considerable distance, unerringly striking the object aimed at with the edge of the hatchet.

Toma'to, or **Love-apple** (*Lycopersicum esculentum*), a plant belonging to the nat. ord. Solanaceæ. It is a native of South America, but has been introduced into most other warm or temperate countries. It is cultivated for the sake of its fruit, which is fleshy, usually scarlet or orange, irregularly shaped, and is largely used in sauces, stews, and soups, as well as eaten by itself. The plant is a tender, herbaceous annual, with yellow flowers, and is now much cultivated under glass in many parts of Britain.

Tombac, or **Tombak**, an alloy consisting of about 85 parts copper and 15 parts zinc, and used as an imitation of gold for cheap jewellery. When arsenic is added, it forms white tombac.

Tombig'bee, a river which rises in Tishomingo county, Mississippi, United States, and, after a course of 450 miles, joins the Alabama River 45 miles above Mobile to form the Mobile River (q.v.).

Tomello'so, a town of Spain, in Ciudad Real. It is a centre of the wine trade, a great part of the claret and 'cognac' of commerce being produced there. Pop. 17,730.

Tomsk, a former government of Western Siberia, belonging chiefly to the basin of the Ob. It is agricultural, but has manufactures of leather and beer, &c., and lead (argentiferous) and copper, &c., are found. Area, 331,160 sq. miles; pop. 3,920,800. Tomsk is the capital.

Tomsk, a town of Western Siberia, capital of the former government of Tomsk, on the Tom, and a feeder of the Trans-Siberian Railway. Manufactures include cloth, leather, and soap; and there is an extensive trade in furs, fish, and cattle, obtained in exchange for articles of European and Chinese manufacture. The University of Tomsk was founded in 1888. Pop. 112,000.

Ton, a denomination of weight equivalent to 20 hundredweights (contracted cwt.), or 2240 lb. In America goods are sometimes weighed by the short ton, of 2000 lb., the hundredweight being reckoned at 100 lb.; but it is decided by Act of Congress that, unless otherwise specified, a ton weight is to be understood as 2240 lb. avoirdupois.

Tonbridge (formerly **Tunbridge**), a town of Kent, England, on the Medway. It has a public school (founded 1553), and manufactures wooden (*Tonbridge*) fancy-ware. Pop. 15,000.

Tone, Theobald Wolfe, Irish rebel, born in Dublin in 1763, died in 1798. Educated at Trinity College, he studied law in London, and was called to the Irish Bar (1789). He was an ardent sympathizer with the doctrines of the French Revolution, and, having promoted the combination of the Irish Catholics and Dissenters, he founded the Society of United Irishmen in 1791. The discovery of his secret negotiations with France drove him to the United States (1795). He sailed for France in 1796, and became brigadier in Hoche's projected expedition to Ireland. In 1797 he served in the Bavarian army, and in 1798 he was captured on board a French squadron bound for Ireland. Brought to Dublin, and sentenced to death by a court-martial, he committed suicide in prison.

Tongaland, a district of Zululand, and the northernmost district of Natal. It is bounded on the north by Portuguese East Africa, and on the west by Swaziland, has a seaboard on the Indian Ocean, and contains Kosi Lake. Tongaland (or Amatongaland) is the home of the Amatonga. The country became a part of Zululand in 1895, and since 1897 has formed part of Natal.

Tongres (toŋ-gr; Fl. *Tongeren*), a town of Belgium, in the province of Limburg, on the Geer. Manufactures include leathers, umbrellas, paper, tiles, and beer. Pop. 10,600.

Tongue, the organ found in the mouth of most vertebrate animals, which exercises the sense of taste, and also assists in speech and in taking food. The name tongue is also given to very different structures in Invertebrata. In man the tongue is attached by its base or root to the hyoid bone and the lower jaw, its other extremity being free. The upper surface is convex with a fibrous middle septum, called the *raphé*. The front two-thirds of the tongue are rough, and bear the *papillæ*, which are sensitive to impressions of taste. The posterior third is smooth, and exhibits the openings of numerous mucous glands. The substance of the tongue consists of numerous muscles. The papillæ, which cause the characteristic roughness of the tongue, are of three kinds, *circumvallate*, *fungiform*, and *filiform*. The largest or circumvallate papillæ number from eight to ten, and occupy the posterior part of the upper surface. They vary from $\frac{1}{20}$th to $\frac{1}{12}$th inch in diameter. The fungiform papillæ are scattered irregularly, the filiform over the front. In structure the papillæ are like those of the skin, and contain capillary vessels and nervous filaments. Numerous *follicles* and *mucous* or *lingual* glands exist on the tongue, the functions of these latter being the secretion of mucus. The nervous supply is distributed in the form of three main nerves to each half of the organ. The *gustatory* nerves and the *glossopharyngeal* branches are the nerves providing the tongue with common sensation, and also with the sense of taste; while the *hypoglossal* nerve carries to the muscles of the tongue the necessary stimuli for contraction. The conditions necessary for the exercise of the sense of taste are, firstly, the solution of the matters to be tasted; secondly, the presence of a special gustatory nerve; and thirdly, that the surface of the tongue itself be moist. The top and edges of the tongue are more sensitive to taste than the middle portion. The sense of touch is very acute in the tongue.

Tonic, in medicine, any remedy which improves the tone, or general condition, of the body tissues. There are two main groups of medicinal tonics: (1) those which act by increasing the secretion of gastric juice, and thus improve the digestive powers, such as the various bitters, of which the chief are *gentian*, *quassia*, *calumba*, *nux vomica*, and *cinchona*; and (2) those which act through the blood-stream, as the numerous preparations of *iron*, certain *mineral acids*, and *salts*. Many non-medicinal remedies have a tonic effect, e.g. open-air exercise, the various forms of electric treatment and massage, sea-bathing, the influence of climate, and sunshine.

Tonic Sol-fa Notation, in music, a system of notation which has come into extensive use among the English-speaking population of the globe, chiefly through the untiring efforts of the Rev. John Curwen (q.v.), who obtained the leading features of his plan from Miss Glover of Norwich. The following is an outline of the system: As of the two relations of musical sounds, those of pitch and key (see *Staff*), the latter is of transcendent importance, every means should be taken to impress this fact on the mind and ear of the learner. Any diatonic scale is a natural scale, whether it is founded on the key of C, D, E, or on any other tone thus represented by a letter-name in the ordinary notation. The tonic or key-note of the scale is always called **doh**, the second **ray**, the others **me**, **fah**, **soh**, **lah**, **te**, successively, no matter what the absolute pitch of the sound may be, the initials only being ordinarily used in printed music: thus, **d**, **r**, **m**, **f**, **s**, **l**, **t**. To designate a sound of absolute pitch, the tonic-solfaist uses the first seven letters of the alphabet just as the followers of the other musical system do. Time and accent are marked thus, | : |, or | : : |, or | : ı : |, &c.; the space between the lines and dots indicating the aliquot parts of the bar (the beat or pulse), the line showing the strong accent, the short line the medium accent, and the colon the weak accent. Accidental or chromatic tones are indicated by a change in the vowel sounds of the syllables; thus, doh, ray, fah, &c., when sharpened become de, re, fe, &c.; and me, te, &c., flattened become ma, ta, &c. The higher octaves are marked $d^{|}$, $r^{|}$, $m^{|}$, &c., the lower $d_{|}$, $r_{|}$, $m_{|}$, &c. The last two lines of the psalm tune *French* would therefore be printed thus:

Key F
: s | $d^{|}$: t | l : s | s : fe | s : m | r : d | d : $t_{|}$ | d

In teaching the system great use is made of the *modulator*, a chart which represents pictorially in an upright position the relative places of the notes of the scales, the chromatic notes, the closely related scales, &c.

The tonic sol-fa method of teaching singing is in principle a return to the ancient *moveable do* system attributed to Guido Aretino (q.v.). The teacher of sol-fa trains the learner to appreciate and store in his memory the characteristic *mental effect* of each note of the diatonic scale; this mental effect depends almost entirely on the position of the notes in the scale relative to the tonic, and hardly at all on their absolute pitch. It must be remembered that there is an essential difference between the sight-reader's and the player's method of using a system of musical signs. The player is directed to execute a certain mechanical operation, and even if his 'ear' is defective, he may become a fairly competent performer. To the singer, on the other hand, mental effect, or 'ear', is everything; he cannot (in general, at least) make his vocal chords sound a given number of vibrations at will. It is therefore a very valuable feature of tonic sol-fa that it makes use of mental effect, and appeals directly to the singer's feeling for *relative* pitch. And there are other advantages in the system, from the point of view of the teacher and learner of singing, notably its simple way of dealing with modulation, or change of key. The immense advance in the quality of choral singing in Britain, and the greatly increased diffusion of musical knowledge, are undoubtedly due in very large measure to the introduction of Curwen's system.

Tonka (or Tonga) Bean, the fruit of the *Dipterix odorāta* or *Coumarouna odorāta*, a shrubby plant of Guiana, nat. ord Leguminosæ, sub-order Papilionaceæ. The fruit is an oblong, dry, fibrous drupe, containing a single seed. The odour of the kernel is extremely agreeable. It is used in perfumery. Called also *Tonkin-bean*, *Tonquin-bean*.

Tonnage. See *Shipbuilding*.

Tonnage and Poundage were duties formerly imposed in England on exports and imports. Tonnage was a duty upon all wines imported. Poundage was an *ad valorem* duty of 12*d.* in the pound on all merchandise imported or exported. They were first levied by agreement, and were granted by Parliament to the Crown for a limited period in 1370. They were afterwards granted to successive sovereigns until 1787, when they were finally abolished by 27 Geo. III, c. 13.

Tonquin, a protectorate of French Indo-China, formerly an integral portion of the domains of the King of Annam (see *Annam*).

Tönsberg (tunz'ber*h*), the oldest town in Norway (founded 871), on the Drammen-Skien State Railway, and Christiania Fjord. It is a considerable shipping centre to which the bulk of the Norse sealing-fleet belongs, which leaves there every March for the Polar Seas. Pop. (1920), 12,588.

Tonsils are two masses of lymphoid tissue, situated on each side of the fauces or throat. Each tonsil lies in a depression on the side of the throat, and is partly embedded in the tissues and partly raised above the surface. They vary much in size, and in children are usually much larger than in adults. Large tonsils cause interference to satisfactory breathing and swallowing, and are always a possible source of infection and seat of inflammation (*tonsillitis*). When the tonsils are large, or when they become infected, they should be removed, and this is most effectively done in early childhood.

Tonsure (Lat. *tondēre*, to shear), the name given to the bare place on the heads of the Roman Catholic and Greek priests, formed by shaving or cutting away the hair. The custom of cutting away the hair in token of the dedication of a person to the service of God is mentioned as early as the fourth century. Many religious orders (for example, the Franciscans) allow only a narrow strip of hair around the head to grow; all above and below is shaved. Shaving the hair precedes consecration; it is performed by the bishop. The tonsure admits the subject into holy orders, and the extent of the tonsure increases with the rank held.

Tontine, a kind of life annuity, so called from their inventor, Lorenzo Tonti, an Italian of the seventeenth century. A tontine is an annuity shared by subscribers to a loan, with the benefit of survivorship, the annuity being increased as the subscribers die, until at last the whole goes to the last survivor, or to the last two or three, according to the terms on which the money is advanced. By means of tontines many Government loans were formerly raised.

Tooke, John Horne, British politician and philologist, son of John Horne, a rich poulterer, was born in Westminster in 1736, died in 1812. He was educated at Westminster and Eton, afterwards proceeding to St. John's College, Cambridge. In 1760 he entered the Church, and obtained the living of New Brentford. A close friendship with Wilkes ended in a public altercation in 1770 and 1771. The year 1771 also witnessed his contest with Junius, in which, in the general opinion, he came off victor. In 1773 he resigned his benefice to study for the Bar (to which from being in orders he was not admitted); and by his legal advice to Mr. Tooke of Purley, he became that gentleman's heir, and assumed his name. In 1777 he was prosecuted for a seditious libel condemning the American War, and his trial resulted in a year's imprisonment and a fine of £200. He was a short time member of Parliament for Old Sarum. He wrote several political pamphlets and an ingenious linguistic work entitled *Epea Pteroenta, or The Diversions of Purley.* A tablet to his memory was unveiled at Ealing (St. Mary's Church) in 1919.

Toole, John Lawrence, British comedian, born in London 1833, died in 1906. Educated at the City of London School, he was employed as a clerk for some time, but subsequently took to the stage, and made his first appearance at the Haymarket in 1852. In 1880 he commenced the management of the Folly Theatre, London, which he afterwards reconstructed and named after himself. In 1874 he visited America, in 1888 he published his *Reminiscences*, and in 1890 made a successful tour in the Antipodes. Toole was exceedingly popular, and was inimitable in his personation of semi-pathetic, semi-ludicrous characters. Among his most successful impersonations were Paul Pry, Caleb Plummer in the *Cricket on the Hearth*, and Uncle Dick in *Uncle Dick's Darling.*

Tools, Hand. Modern tools are developments of the crude implements devised by primitive man. Improvements have kept pace with the growth of human energy and activity. Increased production has led to increased demand, and the evolution of the most efficient appliances has been only a question of time. The form of any particular appliance has been dictated by considerations of convenience in handling, and by the physical properties of the material worked upon. Advances in metallurgy, such as the introduction of new steels for specific purposes in the arts, have naturally reacted on tool manufacture.

The processes dealt with in hand operations are sawing, shaping to desired form by simple cutting operations, and smith forging on an anvil. In addition to these, which have reference solely to the production of definite shapes in wood, metal, or other material, there are many other activities in the arts, such as the use of the trowel in building operations, the production of joints in lead pipes and struts, the cutting and welding of iron and steel by gas or with the electric arc, which are also to be classed as manual operations.

Saws.—For cutting down growing timber, saws of the chain type, with the toothed elements mounted by pin connection with each other, or of the double-handled flat-bladed type, are in common use. In simple carpentry and joinery, hand saws with a slightly tapered width of blade and having teeth suited either for cutting across or with the grain of the timber are available. The shapes of the teeth of cross-cut and hack saws are necessarily different to suit the conditions of their employment. The teeth of a saw blade are turned alternately to each side, and thus the width of the groove cut is always greater than the width of the saw blade. In metal working a narrow steel blade with teeth on one edge is gripped in a simple steel frame provided with a handle. Blades of even smaller widths, going down to the narrowest steel ribbon, are used in fretwork, and for that purpose must also be clamped in a frame to keep the blade taut.

Wood-working *chisels* may be of the simple cutting type with wide flat backs, or in the curved form as *gouges.* The ordinary flat chisel is operated by simple hand pressure, but for mortising, hammer operation is common, and the blade must, in consequence, be made of much thicker material. A process common in the fitting work of an engineering establishment is the reduction of material to size by chipping. For this purpose a heavy chisel made of round bar with the nose shaped into a tapered and flat-sided form is the common tool. In the process of using this tool, it is held in position and driven slightly into the material, turning up a ridge on the surface. The tool is then set to an angle suited to the depth of working, which only practice will show, and a strip of metal is hammered away from the material in small lengths. The irregularities on the surface of the job may be removed after the chipping is completed by the process known as filing.

Files have teeth cut across their surfaces, which tear away the upstanding material as they are driven by hand pressure across the work. The widths and depths of the teeth give an index to the class of work for which the file is suited, and range from bastard to smooth.

Hand *braces* are available for drilling small holes. The *bits* used for wood-working may, like the *centre* bit, have a centre prong, a cutter point just a little shorter, and a curved blade to get under the material and clear it away; or be formed with a helical groove on its length, or with a coned rose point, as in the countersinking type. Metal, such as constructional steel, can also be drilled by the use of the hand tool known as the *ratchet brace*. In this case a back support for the tool is required to deal with the thrust, and the feed is given to the screwed extension of the drill chuck by a nut, which receives motion on its stepped outer surface from a pawl. Similar but lighter tools are available for wood-working, but the thrust is then taken by the body of the workman. Screw threads are made in holes with tapered *taps* of tool steel with teeth cut on them, and *dies* are available for use in *stocks* on similar work on rods.

By heating and hammering, wrought iron may be shaped to almost any desired form. The *anvil* provides a flat surface for working on, as well as a conical nose, which is useful in shaping circular openings in work or bending the metal to the desired curves. Shaped formers and what is termed a *swage block*, having holes of various dimensions and shapes, are useful in the production of many classes of smith-work.

Toon, or **Toona**, the wood of an East Indian tree, the *Cedrēla Toona*, nat. ord. Cedrelaceæ. It is sometimes called *Indian mahogany*, and also *Indian cedar*. Another species (*C. austrālis*) yields the so-called cedar-wood of New South Wales. Toon-wood is highly valued as a furniture wood, and is used for door-panels, carving, &c. See *Cedrela*.

Toowoomba, the chief town of the Darling Downs district of Queensland, Australia, 100 miles west of Brisbane. It is the centre of a large agricultural settlement. Pop. (1921), 24,200.

Topare (formerly **Pollanarrua**), a ruined city of Ceylon, about 50 miles north-east of Kandy, the Sinhalese capital between A.D. 770 and 1235. There is an enormous wall and many other relics.

Topaz, a mineral, ranked among gems; lustre vitreous, transparent to translucent; colour yellow, white, green, blue; fracture subconchoidal, uneven; perfect basal cleavage; specific gravity 3·5. It is harder than quartz. It is a silicate of aluminium, in which the oxygen is partly replaced by fluorine. It occurs massive and in crystals. It crystallizes in orthorhombic prisms, terminated by pyramid planes at one end and a basal plane at the other. Topazes occur generally in igneous and metamorphic rocks, and in many parts of the world, as Cornwall, Scotland, Saxony, Siberia, Brazil, &c. The finest varieties are obtained from Brazil and the Ural Mountains. Those from Brazil have deep yellow tints; those from Siberia have a bluish tinge; the Saxon topazes are of a pale wine-yellow; and those found in the Scottish Highlands are of a sky-blue colour.

Tope (*Galeus vulgāris*), a European fish of the shark kind, attaining a maximum length of 7 feet. It possesses a nictitating membrane and three rows of triangular saw-edged teeth. The species is viviparous.

Tope′ka, a city of Kansas, United States, the state capital and the county seat of Shawnee county, on Kansas River; served by the Atchison, Topeka, & Santa Fé Railroad. There are flour-mills, iron-foundries, a rolling-mill, machine-shops, brick-kilns, breweries, and railway shops. Founded in 1854, it became state capital in 1861, and a city of the first class in 1881. Pop. 50,100.

Torgau, a town of Prussia, province of Saxony, on the Elbe; a junction for Pratau on the Halle-Kottbus railway. Pop. 13,500.

Tor′mentil (*Potentilla tormentilla*), a trailing plant common in Britain in heathy or waste places. See *Potentilla*.

Torna′do, the most violent and destructive of all storms. A tornado is distinguished by the funnel-shaped cloud that extends downwards from the storm-cloud to the earth, and moves forward, with a noise like prolonged peals of thunder, at the rate of about 40 miles per hour. The speed is rarely below 30 miles per hour, and the diameter of the storm averages only about 1000 feet. Where a tornado crosses open water a waterspout is formed. The atmospheric disturbances which are denoted by the word tornado are more or less peculiar to the United States, where they are confined to the plains of the south, and especially to the Missouri and Mississippi basins. Spring and summer are the prevalent seasons, tornadoes being hot-weather phenomena; and the afternoon, between 3 and 5.30 p.m., is the general time of occurrence. The passage of the spiral cloud is accompanied by violent thunderstorms and heavy rain, and hail frequently falls in its wake. Meteorological observations and records of tornadoes are more or less impossible, since, within the diameter, men are lifted up like straws and generally dashed to death; and within the storm, pressure being reduced to three-quarters or even half its normal value, everything is made to burst with explosive violence.—Cf. A. E. M. Geddes, *Meteorology*.

Tornio (Sw. *Torneå*), a river of North-Western Europe, rising in Sweden and flowing to the head of the Gulf of Bothnia; length, 250 miles. The Lower Tornio forms the Swedo-Finnish frontier.

Tornio, a seaport-town of Finland, in the department of Uleåborg and Petsamo, at the mouth of the Tornio River, opposite Haparanda (Sweden), with which there is a bridge connection. It is the frontier-head of the important international railway (4·9-foot gauge) to Petrograd, which all goods and passengers make use of when entering Russia (from the west) in normal times. Pop. 2500.

Toro, (1) a town of Spain, in the province of Zamora, on the Douro; served by the railway Zamora-Medina del Campo (56 miles). Woollens, leather, and wine are made. Pop. 9000. (2) A town of Spain, in the province of Castellon; stands near the Calatayud-Valencia Railway.

Toro, the northern district of the Western Province of Uganda, extending roughly north and south between Lakes Albert and Edward, and including the Uganda zone of the Semliki Valley, part of Ruwenzori, and nearly the whole of Lake George (3015 feet altitude; area, 114 sq. miles), which is connected by Kazinga Channel (the southern boundary of Toro) with Lake Edward. Low hills and swamps characterize the Buganda frontier zone, but merge in the east-central plains of short grass studded with verdurous hills, which, crossed in the west by a dense ribbon of elephant- and buffalo-haunted jungle, extends unbroken to the slopes of Ruwenzori. From Lake George with its tsetse-infested shores the surface rises to the north-eastern extension of Ruwenzori, the Portal Peaks (14,000 feet), behind which is the Mwenge zone, an open plain with occasional papyrus swamps, that descends rapidly as the Nkussi River is approached. The whole region possesses many relics of intense seismicity and vulcanicity, including a wealth of crater-lakes filled with warm blue water, hot springs on the flanks of Ruwenzori, and upstanding volcanic plugs and necks innumerable. The Mpanga is the chief river, and, with the Hima and Rivimi, flows to Lake George. All three rise in Ruwenzori. Fort Portal (5299 feet) is the head-quarters (mean annual temperature, 68·1° F.; March mean, 69·7° F.; October, 66·4° F.; mean annual rainfall, 55·4 inches). Toro is an autonomous kingdom ruled by a *Mukama*, through a *Katikiro* (Prime Minister) and *Lukiko* or council of *saza* chiefs, each of whom presides over one of the ten *sazas* into which Toro is subdivided. Hematite is mined and worked to a limited extent by the natives, but the chief occupations are cattle-, sheep-, and goat-tending, and the raising of millet, peas, beans, sesame, ground-nuts, manioc, bananas, maize, dhal, some tobacco, and a little coffee. Little or no cotton is grown. There are large forests (chief tree ironwood, *Cynometra Alexandri*), and many species of game (chimpanzee, Colobus monkey, elephant, situtunga, and waterbuck) are found.

Toron'to, a city of Ontario, Canada, in York county, the provincial capital, and the second city and educational centre of the Dominion. It is 333 miles from Montreal by rail, and is served by the two great transcontinental lines (Canadian Pacific and National), and by steamers plying on Lake Ontario, along a bay of which the city extends for 10 miles. The harbour accommodation is in course of improvement. The University of Toronto (about 5500 students) has faculties of arts, science, medicine, applied science and engineering, forestry, education, music, and household science, and is one of the best-equipped in all America. Queen's Park, adjoining the university (area, 1700 acres), contains a fine legislative building. Toronto receives electric power from Niagara Falls, and its hydro-electric undertakings are the most comprehensive municipal-supply schemes in America. The street railways were taken over by the municipality in 1921. Industries include: engines and machinery, cars and carriages, furniture, ironmongery, agricultural implements, etc. The Canadian National Exhibition is held there annually in September in permanent buildings, over a million persons attending it. It is a great centre of banking and insurance, and leads the Canadian publishing industry. Toronto was founded in 1794 and was first named York. Its growth has been phenomenal. Pop. in 1881, 86,415; in 1891, 181,215; in 1901, 208,040; in 1908, 287,201; in 1920, 499,500.

Torpe'do, the name of fishes allied to the rays, family Torpedinidæ, and noted for their power of giving electrical shocks. The electrical organs consist of two masses placed on each side of the head, composed of numerous gelatinous columns separated by membranous septa, and richly furnished with nervous filaments. Their production of electricity is explicable on the ground of the conversion of nerve force into electric force by the electric organs; just as nerve force is converted into motion through the muscles. The species of the type genus Torpedo occur chiefly in the Mediterranean, Red Sea, and in the Atlantic and Pacific Oceans. A large specimen may measure 4 feet long, and weigh from 60 to 70 lb.

Torpedo, in naval warfare, a case or shell containing explosive material, and capable of being propelled under water so as to explode when it comes into violent contact with the hull of a hostile ship. Early forms were controlled electrically or mechanically from the shore or ship by means of wires. One example of this type, the Brennan, which is still in use for harbour defence, is fitted with two drums of fine steel wire, which are unwound by an engine on shore, and communicate their rotation to propelling screws. The modern uncontrolled torpedo is the invention of Robert Whitehead (1823–1905), a British engineer who settled in Fiume in 1856. Its essential features are the provision of internal power and machinery for maintaining speed and preserving direction. The shape of the torpedo, and the arrangement of its main internal elements, are shown in the diagram (fig. 1). The *head* C contains the *charge* D of T.N.T., which, when the *pistol* A strikes a target, becomes ignited, with the help of a detonator of fulminate of mercury and a priming charge in the *primer* B. The *air-vessel* E contains the compressed air which gives the torpedo its motive power. The compartment F, the *water-bottle*, shuts off the air-vessel from the engine and air-heating apparatus. G is the *charging-valve*, and H the *stop-valve*, in the main air-pipe. J is the engine, and I is the *air-lever*, by means of which it is started (cf. fig. 2, at D). The depth-keeping mechanism consists of the *pendulum weight* K, and the *hydrostatic valve* L, which by their joint action operate the horizontal rudder S, with the help of the small air-engine O, called the *servomotor*. M is the *fuel-bottle*, and N the *generator*; the purpose of these is to heat the compressed air, and so increase its pressure before it enters the engine. P is the *buoyancy chamber*, Q the *propellers*, and R the *gyroscope*, which, if the torpedo suffers any deflection, tends to preserve its plane of rotation, and therefore so acts on the *vertical rudder* T as to restore the torpedo to the correct course.

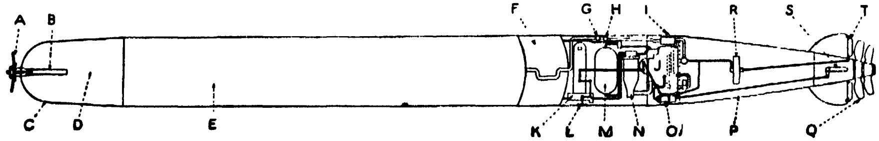


Fig. 1

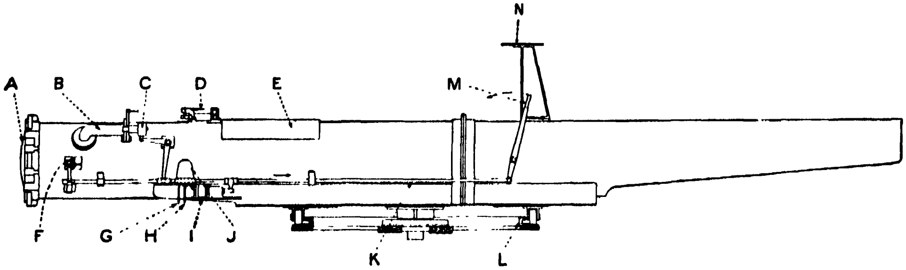


Fig. 2

A, Rear door. B, Cartridge pocket. C, Percussion lock, for firing cartridge. D, Tripper, which starts engine in torpedo by striking air-lever. E, Access door. F, Side-stop, for holding torpedo in place until first movement of firing gear. G, Electric cable to firing key on fore bridge. H, Air-pipe from reservoir. I, Air-ram, for operating firing shaft. J, Electromagnet, for operating air-ram. K, Firing shaft. L, Racer, by which tube can be trained on either beam. M, Firing lever. N, Director stand.

The chief parts of the *tube*, from which the torpedo is discharged, are indicated in fig. 2. The Brotherhood engine, of the 3- and 4-cylinder types, has a notable record of service in the history of torpedo construction; it has now, however, a formidable rival in the turbine form of drive, which has already been extensively adopted. The torpedoes used in the British navy are 18 inches and 21 inches in diameter, the smaller size for use in coastal motor-boats, submarines, and air-craft; the larger for use in capital ships, light-cruisers, and destroyers. In the European War the torpedo played an important part, especially in the hands of the German submarine commerce destroyers (see *U-Boat*). In the battle of Jutland the German fleet sustained considerable damage from torpedoes, and was successful in obtaining one or two hits on our ships. Seaplanes carrying torpedoes were used to some extent during the war, and seem likely to play a more important part in the future.

Torpedo-boat Destroyer. See *Navy*; *Shipbuilding* (*Naval*).

Torquay (tor-kē′), a municipal borough, seaport, and watering-place of Devonshire, England, on Tor Bay. Its mild winter climate attracts many visitors, and there are theatres, baths (including tonic baths), and a promenade pier, as well as golfing, yachting, and sea-bathing facilities. Pop. (1921), 39,432.

Torre Annunziata, a seaport of Campania, South Italy, in the province of Naples. It lies on the Bay of Naples, at the foot of Mount Vesuvius, from the eruptions of which it has often suffered. Pop. 25,070.

Torre del Greco, a seaport and health-resort of Campania, South Italy, in the province of Naples, on the Bay of Naples, at the foot of Mount Vesuvius. There are shipbuilding-yards, stone-work industries, &c. Pop. 35,000.

Torrens, Lake. See *South Australia.*

Torres Strait, the strait which separates Australia from New Guinea, being about 80 miles across. It is crowded with islands, shoals, and reefs, rendering its navigation difficult. Pearls, pearl-shell, and bêche-de-mer are found and extensively worked.

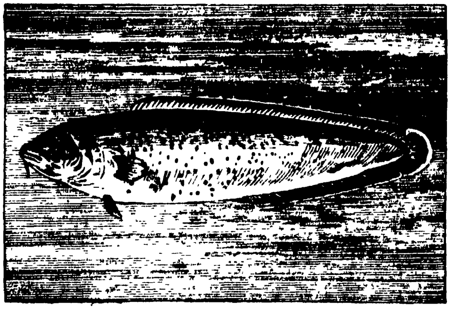
Torricelli (tor-ri-chel'lē), Evangelista, Italian physicist, born in 1608, died in 1647. He owed much to the inspiration of Galilei, whom he succeeded as professor of mathematics in the Florentine Academy. Torricelli was the discoverer of the method of obtaining a barometric column by filling a glass tube with mercury and inverting it under the same liquid. The fact that the mercury did not fall in the tube he explained as an instance of the principle that nature abhors a vacuum. The true explanation was first given by Pascal. *Torricelli's Theorem* in hydraulics (q.v.) gives the velocity of efflux of liquid from an orifice.

Torrington, a municipal borough of Devonshire, England, on the Torridge. Glove-making is the principal industry. Pop. (1921), 2931.

Torrington, a town of Connecticut, United States, in Litchfield county; served by the New York, New Haven, & Hartford Railway. It is an industrial town, founded in 1734. Pop. 23,000.

Torsion Balance, an apparatus used by Coulomb in France, first to determine the laws of torsion or twisting of wires; it was then used by Coulomb to prove the law that the force of attraction or repulsion between two magnetic poles varies inversely as the square of the distance between the poles. It was also employed in proving the corresponding law relating to electric charges. These are known as Coulomb's laws. In the last case, the two charges were carried on two equal insulated metal balls; one of these was held at the end of an arm suspended horizontally by means of a thin vertical silver wire; the other was carried on a fixed vertical support, all being enclosed in a glass case. A charge on one ball was shared between the two, and the distance between the balls could be given different values by turning the torsion head. In order to reduce the distance between the balls to one-half, the torsion had to be increased four times. Hence followed the inverse square law.

Torsion Meters. The rate of working of a steam-engine may readily be determined by the use of an indicator (q.v.). In a steam turbine the same purpose is served by the torsion meter. When power is being transmitted through a shaft, a certain twist is produced in it, the magnitude of which depends on the material and the torque. This principle admits of application in the case of steamships propelled by steam turbines, but as the twist is not considerable, it must be measured over as great a length as possible. In the usual arrangement two sleeves are clamped to the propeller shaft at the standard distance apart. They are arranged so that their free ends are brought together for the purpose of comparison. As the sleeves revolve with the shafting, simple observation of the twist is not possible. The reflected light from mirrors connecting the two sleeves serves to show the magnitude of the torsion in one system. In another, brushes on a series of small commutator bars give the means of finding the desired information. The torsion meter is a useful instrument available for other power measurements than those of ship propulsion. It is manufactured in standard sizes for various types and sizes of work.



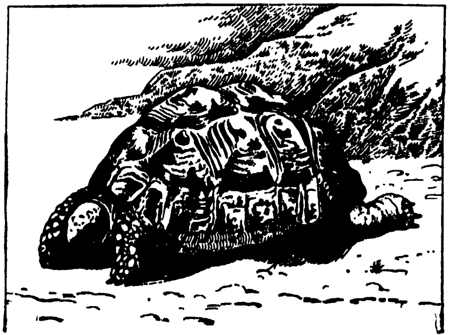
Torsk (*Brosmius brosme*)

Torsk (*Brosmius brosme*), a fish of the cod family, found in great quantities off the Orkney and Shetland Islands, where it constitutes a considerable article of trade. The species ranges north to Spitzbergen, and south to Cape Cod on the American coast. It is, when salted and dried, a savoury stock-fish. It is from 18 to 30 inches long, and is called also *tusk.*

Torso (It.), an art term signifying the trunk of a statue of which the head and the extremities are wanting. The *torso* of Heracles, in the Belvedere at Rome, is considered by connoisseurs one of the finest works of art remaining from antiquity. It is a masterpiece of the later Greek sculpture, and is the work of Apollonios, son of Nestor, an Athenian.

Torstenson, Lennart, Swedish general, born 1603, died 1651. He distinguished himself in the Thirty Years' War, being appointed leader of the Swedish army in Germany in 1641, and having command of it for five years.

Tort, in law, denotes injustice or injury. Actions upon torts or wrongs are all personal actions for trespasses, nuisances, assaults, defamatory words, and the like.



Greek Tortoise (*Testūdo græca*)

Tortoise (tor′tis), the name applied to various genera of reptiles included in the order Chelonia, along with the turtles and their allies. The distinctive features of the tortoises and other chelonians consist in the modification of the skeleton and of the skin-structure or scales to form the well-known bony box in which their bodies are enclosed, the upper portion of which is the *carapace*, the lower the *plastron*. The Testudinidæ include the typical land-tortoises, and have short stunted limbs adapted for terrestrial progression; the short toes are bound together by the skin, and have well-developed nails. The carapace is strongly convex, and is covered by horny epidermic plates. The horny jaws are adapted for cutting, or may be divided into serrated processes. The head, limbs, and tail can be completely retracted within the carapace. Though capable of swimming, the tortoises proper are really terrestrial animals, and are strictly vegetable feeders. The most familiar example is the common Greek or European tortoise (*Testūdo græca*), which is frequently kept as a household pet. It occurs chiefly on the eastern borders of the Mediterranean. These animals sometimes live to a great age (over a hundred years according to some), and hibernate through the colder season of the year. They attain a length of 12 inches. The gopher tortoise (*T. polyphemus*) is native to the south-east of the United States; and another species (*T. tabulata*) is widely distributed through tropical South America. Gigantic species are found in the Galapagos Islands and some of the islands in the Indian Ocean. The box tortoises (Cinixys) are remarkable for the curious development of the front part of the plastron, which shuts over the anterior aperture of the shell like a lid when the animal retracts itself. Species are found in tropical Africa. In the box tortoise of North America (*Cistūdo carolīna*) the hinder part of the plastron forms a lid. The family Testudinidæ also includes aquatic forms, including the American water-tortoises or terrapins (Chrysemys) that range from Canada to the Argentine; the European pond tortoise (*Emys orbicularis*), with a related species (*E. blandingi*) in North America; the Iberian water-tortoise (*Clemmys leprosa*), ranging into North-Western Africa, with allied species in the Balkans and Asia Minor, and also in North America; and a North American type (Malacoclemmys), of which one species (*M. terrapin*) is esteemed in the Eastern states as the best of the edible terrapins. The mud or soft tortoises (Trionychidæ) occur in Asia, Africa, and North America. They have soft fleshy lips, and no horny plates are developed in the skin. Very frequently also the ribs are not so modified as to form a hard carapace, as in other chelonia. See *Turtle*.

Tortoise-shell, a name popularly applied to the shell or rather the scutes or scales of the tortoise and other allied chelonians, especially to those of the *Chelonia imbricāta* (the hawk's-bill turtle), a species which inhabits tropical seas. The horny scales or plates which form the covering of this animal are extensively used in the manufacture of combs, snuff-boxes, &c., and in inlaying and other ornamental work. It becomes very plastic when heated, and when cold retains with sharpness any form it may be moulded to in its heated state. Pieces can also be welded together under the pressure of hot irons. It is now largely imitated by horn and cheap artificial compounds.

Tortoise-shell Butterfly, a name given to two British butterflies, the small tortoise-shell (*Vanessa urticæ*) and the large tortoise-shell (*V. polychlōros*), from the colouring of the wings.

Torto′la, the chief island of the British possessions in the Virgin group. It contains Road Town (pop. 440), the group capital.

Torto′na, a town of Piedmont, Northern Italy, in the province of Alessandria. Pop. 20,150.

Torto′sa, a walled city of Tarragona, Spain, on the Ebro. There is a cathedral (1347), and ruins of a Roman city. Pop. 20,097.

Tortu′gas, or **Dry Tortugas,** a group of ten small low barren islands belonging to Florida, United States, about 40 miles west of the most westerly of the Florida Keys. On Loggerhead Key there is a lighthouse.

Torture. The use of torture to extract evidence from accused persons goes far back in legal history, and has completely disappeared only in comparatively recent times. It existed under Roman law (although it was not until the period of the Empire that freemen could be treated in this way), and from Roman law it spread into the legal systems of Mediæval Europe, its use rapidly extending after the 'reception' of Roman law in continental Europe in the later Middle Ages. It was also, and at an earlier date, employed by the Inquisition (q.v.) in cases of heresy, which was regarded by the Church as the equivalent of the crime of treason, and, therefore, as justifying the employment of any method of ascertaining the truth.

The law of England (which never accepted the Roman civil code) was, on the whole, honourably free from this species of barbarity, and Sir John Fortescue, Chief Justice of King's Bench in the fifteenth century, praised the laws of England on the ground that they refused to permit this expedient. There was, however, one recognized form of procedure, known as *peine forte et dure* (q.v.), which involved torture. A prisoner who refused to plead to an indictment for felony and to utter the required formula that he desired to be tried "by God and my country" was liable to be loaded with iron weights and to be pressed to death, and this ferocious rule was not abolished until 1772. There is, however, an important distinction between forcing a man to plead to an indictment and compelling him, under torture, to answer questions designed to entrap him into admissions of his own guilt, or into accusations against his real or supposed accomplices and other suspected persons. The latter procedure was not employed in English law before the accession of the House of York, and, in the trial of the Templars in 1309, Edward II at first refused to allow its use, but gave way when Pope Clement V insisted that no national custom could be allowed to override the canon law. But in the reign of Edward IV torture was introduced as a judicial process, and though it was never in England, as it was elsewhere, part of the procedure of the ordinary courts, it was freely used by the Privy Council and, later, by the Star Chamber. The Tudor reigns were the most notorious period of the employment of torture in England, but there were also instances in the seventeenth century, although in 1628 the judges declared that it was illegal to torture an accused person in order to compel him to reveal his accomplices. In Scotland the use of torture was earlier and more frequent, and reached its climax in the seventeenth century, during which it was an ordinary method of examining both State prisoners and witches. It is specially identified with the administration of the Duke of York in the reign of Charles II, and with the persecutions of the Covenanters, and in the Scottish Claim of Rights (1689) "the using of torture without evidence or in ordinary crimes" was described as illegal; the absence of such a clause in the English Declaration of Rights shows the difference of practice in the two countries. Even after the Revolution, the use of torture to extract evidence was permitted in special cases by the Scottish Parliament in the reign of William and Mary. The most common instruments of torture for the purpose of obtaining evidence were the rack (used everywhere in Europe), the boot, and the thumb-screw; the last mentioned is specially associated with the persecution of the Scottish Covenanters.

Torture was also employed as an aggravation of the capital penalty. Certain modes of execution (such as breaking on the wheel in France) were employed because of the pain they involved; burning at the stake for heresy, or for the murder of a husband, is another illustration. The horrible mutilations which accompanied a sentence of hanging for treason were inflicted in order that torture might serve as a deterrent. Notable instances of the use of tortures as a punishment are the execution of the murderers of James I of Scotland in 1437, and the abominable devices invented in France for the execution of Robert François Damiens, in 1757, for an attempt upon the life of Louis XV. The use of torture, both for extracting evidence and as a penalty, is now abandoned in all civilized countries.—Cf. Jardine, *Torture in the Criminal Law*.

Tory, an English party name which originated during the Exclusive Bill debates (1679–80). It was employed in Ireland to describe native Irishmen who had been dispossessed of their lands and had become outlaws. The process by which this term came to be applied to English supporters of divine right and passive obedience is obscure. According to Defoe, the 'real godfather' of the Tory party was Titus Oates, who asserted that Tories were being brought over from Ireland to murder him, and described everyone who disbelieved in the Popish Plot as a 'Tory'. The name was thoroughly established by the end of the reign of Charles II, the period of the definite formation of political parties. The policy of James II, and especially his attack upon the Church of England (by interfering with the universities and prosecuting the Seven Bishops), shook the faith of the Tories in their own doctrines, and at the Revolution they joined the Whigs in bringing about his deposition, but pacified their consciences with the belief that his flight constituted an abdication. The unpopularity of William III and the disputes of his reign led many Tories to repent the acquiescence of their party in the Revolution, and in the reign of Anne they became favourable to the succession of the queen's half-brother, James, the 'Old Pretender'. In 1710, when the nation was tired of the War of the Spanish Succession, the Tories came into power on a cry of 'the Church in danger', and under Oxford and Bolingbroke they used their supremacy to bring about peace with Louis XIV, the friend and protector of James, and to prepare the way for a Stewart restoration. The death of Queen Anne occurred before their plans were matured, and, under the first two Hanoverian kings, the Tories were regarded as Jacobites and were in permanent opposition. By the date of the accession of George III they had become reconciled to the new dynasty, and, maintaining their old custom of supporting the royal authority, they helped to form the group of politicians known as 'the King's Friends'. After the loss of the American colonies, the Tories, under the leadership of the younger Pitt, were becoming imbued with more liberal doctrines, but the excesses of the French Revolution put an end to this development, and until 1832 the Tories were, first, a war party, and, after 1815, a party opposed to Parliamentary reform. After the Reform Act of 1832, the name 'Tory' was replaced by 'Conservative'.—Cf. C. R. Kent, *Early History of the Tories.*

Tory Island, an island of Ireland, in County Donegal, on Tory Sound, which separates it from the mainland. Fishing is the chief industry. Pop. 300.

Tosti, Francesco Paolo, the popular Italian song-writer, born 1846, died 1916. He showed a definite musical bent in early years, making great progress as a student at the Royal Conservatory of S. Pietro a Majella at Naples, where his special studies were violin-playing and composition. As the result of overwork he had a serious illness at the age of twenty-three, and his first two songs, *Non m'ama più* and *Lamento d'amore*, were written during this period. They have since become very popular; but Tosti experienced the usual difficulties of an unknown man in getting them published. Once having secured a hearing, however, he enjoyed a steadily growing recognition, and became one of the most widely appreciated writers of superior drawing-room songs. While in Italy he enjoyed the friendship of Sgambati, and taught singing to Queen Margherita. On his first visit to London, in 1875, he was well received both as an artist and a man, and returned there yearly till 1880, when he made London his home. He was teacher of singing to the royal family, and received a knighthood in 1908. His songs are characterized by finely flowing melody, attractive harmony, and finished workmanship, and his best lyrics are excellent examples of the superior type of popular song.

Totalizator, the registration machine on the pari-mutuel system of betting which registers the number of bets made on each race. It is a common feature of Continental race-courses, and in France it provides the Exchequer with a substantial revenue. When bets are made on a race they are pooled, and a fixed proportion (generally 10 per cent) is deducted by the officials in charge, the remainder being distributed among the backers of the winning and placed horses.

To'temism, a modified form of the word *totamism*, invented in 1791 by Long, an English trader, who transformed the native American word *oteteman*, 'his brother-sister kin', into *totam*, now spelt *totem*. The term totemism is now applied by ethnologists to certain beliefs and customs of the aboriginal inhabitants of America, Oceania, Australia, Indonesia, and Africa (and in modified forms among many other peoples, ancient and modern), in virtue of which (*a*) each definite social group or clan of the community is associated with some animal (or, in other cases, plant or inanimate object) regarded as its totem, with which members of the group are believed to be genetically related, usually being regarded as its (the totem's) offspring; and (*b*) special respect is shown to the totem—if an animal or plant, it may not be eaten, except on certain special occasions, or if an inanimate object, it may not be used, or used only with certain restrictions.

There is great conflict of opinion as to the origin and significance of this remarkable culture-complex; but recent research (especially the work of W. J. Perry) has made it clear that, in whatever part of the world it is found, totemism was derived directly or indirectly from the religious beliefs and social practices of the Egyptian royal family of the Pyramid Age. The totem animals were the tribal crests, eagle, lion, snake, &c., which were the clans' protectors and badges in warfare. The Egyptian kings were regarded as 'Sons of the Sun', having been born from the Great Mother, the Divine Cow, fertilized without carnal intercourse by the sun.

The inextricable connection of the more primitive forms of totemism with the ideas of children of the sun, virgin birth, matrilineal descent from animals, and the use of protective animal crests, reveals the derivation of its essential elements from Egypt.—Bibliography: W. J. Perry, *The Children of the Sun*; Sir J. G. Frazer, *Totemism and Exogamy*; J. N. B. Hewitt, article *Totem*, in *Handbook of American Indians.*

Totnes, a municipal borough and market town of Devonshire, England. It has a grammar-school founded in 1554. The houses, which overhang the pavements, forming covered walks, are characteristic. Pop. (1921), 11,917.

Toucan (Rhamphastus), climbing birds of the woodpecker order (Coraciiformes), family Rhamphastidæ. These birds inhabit the tropical regions of South America, and are distinguished by a large keeled bill. The bill is about 8 inches long, and its substance is hollowed out into air-cells, thus being comparatively light. The toucans feed on fruits, seeds, insects, &c. The prevailing colours among the toucans are yellow, black, and red. The bill is frequently of a bright colour.

Touch, the sense of feeling and the most widely diffused of the senses. It resides in the skin, and is exercised through certain structures situated in the papillæ of the true skin and connected with terminal filaments of sensory nerves. These structures have some variety of form, and are called tactile cells, tactile corpuscles, compound tactile corpuscles, Pacinian corpuscles, &c. All the kinds are to be regarded as terminal organs of the sensory nerves, acting as the media by which impressions made on the skin are communicated to the nerve fibres. Although the sense of touch is diffused over the whole body, it is much more exquisite in some parts than in others. Experiment shows the tip of the tongue to be the most sensitive surface, the points of the fingers come next, while the red part of the lips follows in order. The neck, middle of the back, and the middle of the arm and thigh are the least acute surfaces. See *Sensation*.

Toco-Toucans (*Rhamphastus toco*)

Touchstone, a variety of extremely compact siliceous schist, used for ascertaining the purity of gold and silver; known also as *black jasper* and *basanite*. It was called *Lydian stone*, or *lapis Lydia*, by the ancients, because found in Lydia in Asia Minor. A series of metallic needles (called *touch-needles*) of which the composition is known are used for comparison with the article to be tested, which is commonly gold or a gold alloy. When the colour of the streak produced by both the needle and the trinket on the stone is the same, the quantity of alloy they contain is supposed to be similar.

Touchwood, a soft white substance into which wood is converted by the action of such fungi as *Polypŏrus igniarius*. It is easily ignited, and continues to burn for a long time like tinder.

Toul (tōl), a town of France, in the department of Meurthe-et-Moselle, on the Moselle; served by the Eastern Railway. It is fortified, and has a Gothic church (St. Étienne), a former cathedral, dating from the thirteenth century. Toul was taken in the Franco-German War (23rd Sept., 1870) after a siege of five weeks, but was restored to the French, who again fortified it. Pop. 12,000.

Toulon-sur-Mer (ancient (Gr.) *Telonion*, (Lat.) *Telo Martius*), a seaport and first-class fortress, after Brest, the chief naval station of France, in the department of Var, situated on Toulon Bay, an arm of the Mediterranean; on the Mediterranean (Marseilles-Nice) Railway. Toulon has a former cathedral (Ste Marie Majeure), large naval dockyards, basins and arsenal, provided with bomb-proof moles and protected by forts. Trade is negligible, but there are shipping businesses. As *Telonion* and *Telo Martius*, Toulon was famous for dyes. The town suffered severely at the hands of the Republicans in 1793 after the withdrawal of the British, whom the inhabitants had voluntarily admitted, and who destroyed the French Republican fleet. Pop. (1921), 106,331.

Toulouse (tö-löz; ancient **Tolosa**), a city of Southern France, capital of the department of Haute-Garonne, on the Garonne and the Canal du Midi; an important junction of the Southern and Orleans Railways. The Pont Neuf spans the river. Toulouse is an educational centre, and is the entrepôt of the district for agricultural produce and general trade, as well as an important industrial centre. The ancient *Tolosa Volcarum*, Toulouse is a place of great antiquity, and rose to eminence under the Romans. It was the capital of the Visigothic kingdom (419–508), passed to Clovis, and subsequently became the capital of Aquitaine. It was long governed by independent counts, before falling to the French Crown and becoming capital of Languedoc. The French were defeated by the

British under its walls in 1814. Pop. (1921), 175,434.

Tourac′o, a name of birds of the genus Corythaix or Turăcus, natives of Africa, belonging to the cuckoo order (Cuculiformes), and family Musophagidæ. Their prevailing colour is green, varied in some species with purple on the wings and tail. They feed chiefly on soft fruits.

Touraine (tö-rān), a pre-Revolutionary province of France, which now forms the departments of Indre-et-Loire (mainly) and Vienne. Tours was the capital. United with Anjou in 1045, it passed to England (the Plantagenets) in 1154, but was reacquired by France (Philip II) in 1204. It was made a duchy in 1356, and united with the Crown in 1584.

Tourcoing (tör-kwaŋ), a town of France, in the department of Nord, contiguous with Roubaix; a junction on the Northern Railway. It is industrial, the staple manufactures being woollen, cotton, linen, and silk stuffs, and there are dye-works, soap-works, sugar-refineries, machine-works, &c. Pop. (1921), 78,600.

Tourgueniev or **Turgeniev**, Ivan Sergeyevitsh, Russian novelist, was born in 1818, and died near Paris in 1883. The descendant of a noble family, he was educated at Moscow, St. Petersburg (Petrograd), and Berlin, and in 1842 obtained an appointment in the Ministry of the Interior. For some years he led the life of a country gentleman, gaining an intimate acquaintance with Russian peasant life. In 1852, having written an article displeasing to the authorities (*Letter on Gogol*), he was imprisoned for a short time, then banished to his paternal estate for two years. The latter part of his life he resided either at Baden-Baden or in Paris. His first important publication was *The Experiences of a Sportsman*, which was followed by a great number of short tales and dramas, contributed chiefly to Russian periodicals. His earliest novel, *Dimtri Rudin*, appeared in 1855, and was followed by *Helene*, *A Nest of Nobles* (*Lisa*), *Fathers and Sons*, *Smoke*, *An Unfortunate*, *Spring Floods*, *Virgin Soil*, &c. Tourgueniev has rightly been ranked with the greatest masters of fiction. He was an artist, possessed of a great power of analysis and psychological insight, and was able to handle the most difficult subjects with a light and delicate touch. His chief characteristics were ‘ tenderness and grace, and a certain mistiness of colour ’.—Cf. W. L. Phelps, *Essays on Russian Novelists*.

Tourmaline (tör′ma-lin), a mineral occurring crystallized in the trigonal system as three-sided or six-sided prisms, terminated by three-sided pyramids. The crystals are differently terminated at opposite ends of the prismatic axis, and the ends show opposite kinds of electricity when heated. Tourmaline scratches glass easily, has a specific gravity of 3, and is a borosilicate of aluminium with sodium, and commonly iron, magnesium, and water. Tourmaline occurs most commonly in igneous and metamorphic rocks, especially in granite, gneiss, and mica-schist. It is transparent, translucent, or opaque; colourless, green, brown, pink, or blue, but commonly black. Pink tourmaline is known as *rubellite*, blue as *indicolite*, and black as *schorl*. The transparent varieties include various well-known jewellery stones, as the Brazilian sapphire, the Brazilian emerald, &c. Tourmaline was once much used in polarizing apparatus, since a section parallel to the principal axis, and not too thin, transmits rays vibrating in one direction only.

Tournai (tor-nā; in Flem. *Doornik*, dōr′nik; Rom. *Civitas Nerviorum* or *Turnacum*), a town of Belgium, in the province of Hainault, on the Scheldt; an important railway junction for Ghent, Brussels, Valenciennes, &c. Manufactures include linens, woollens, cottons, and Brussels carpets. Tournai is one of the oldest towns of Belgium, and was anciently the chief town of the Nervii, and afterwards the residence of some of the early Frankish kings. Captured by the Germans during the European War (23rd Aug., 1914), it was retaken by the British on 8th Nov., 1918. Pop. (1920), 35,542.

Tournament. The tournament or tourney was a form of recreation or sport among the nobility of European countries in the Middle Ages. It was a mock fight of knights on horseback, and the name is supposed to be derived from the necessity of a combatant's turning his horse rapidly. The fight was purely a display of skill and a method of preparation for war, and the combatants were understood to bear no hostility, personal or national, towards each other. Tournaments originated in the eleventh century in France, and rapidly acquired great popularity in England. They were disliked by the Crown, both because an assemblage of men in arms might be utilized as the beginning of a rebellion, and because of the risk to life and limb. Henry II forbade them, and, though Richard I withdrew the prohibition, a royal licence had to be obtained, and Edward I made it a capital offence to hold an unlicensed tournament. The custom afforded an opportunity for friendly international rivalry, but foreign knights were apt to be maltreated by the crowds who came to witness the spectacle. From the close of the thirteenth century the danger to life or limb began to decrease, and one objection to the amusement was removed. The use of pointed swords and daggers was forbidden, sham weapons were sometimes employed, armour was specially designed to be worn by knights in the tourney, and a barrier of wood between the combatants gave additional protection. Accidents occasionally happened—the most famous is the death of Henry II of France in 1559 from a wound in the temple caused by the splintered lance of his opponent — but the tournament tended to become a mere display or pageant, especially in France, though in England the older conception survived to the seventeenth century. In 1839 a famous revival of the tournament was organized by the thirteenth Earl of Eglinton, who held at Eglinton Castle a tournament in which knights fought as of old with spears. One of the combatants was the future Napoleon III. The spectacle was spoiled by rain, and the expenditure of from £30,000 to £40,000 was generally regarded as an indefensible extravagance. The Eglinton Tournament is described in Disraeli's *Endymion*.

There is no book in English on the subject, but a good description of a tournament at Stirling in 1448 will be found in Hume Brown's *Early Travellers in Scotland*, pp. 30–38.

Tourneur, Cyril, English dramatist, was born about 1575, and died in 1626. Almost nothing is known of his life, except that he served in the Low Countries in 1618, and that he accompanied Sir Edward Cecil to Cadiz in 1625. On his return from the expedition he took ill; he was put ashore at Kinsale, where he died, leaving his widow destitute. Tourneur's poems consist of *The Transformed Metamorphosis* (1600), a satire whose key is lost and which is written in an unintelligible jargon; and two elegies, *A Funeral Poem* on Sir Francis Vere and *A Griefe on the Death of Prince Henrie*, neither of which rises above the level of official lamentations. Tourneur's fame rests entirely on his two tragedies, *The Revenger's Tragedy* (published 1607) and *The Atheist's Tragedy* (published 1611). It is almost certain that the play which was published the later was written the earlier of the two. *The Atheist's Tragedy* is immature, *The Revenger's Tragedy* a much stronger and more finished play. As dramas both plays leave much to be desired. They have little dramatic power, and their characters are caricatures. It is the force and flow of Tourneur's poetry that distinguishes his work. In gloom and in tragic cynicism these plays resemble those of Webster; it has been said that Tourneur is to Webster as Webster is to Shakespeare. Swinburne in his characteristic eulogy has undoubtedly overvalued Tourneur, but on the strength of his masterpiece he must be placed among the great Jacobeans.—Cf. A. C. Swinburne, *The Age of Shakespeare*.

Tours (tör; Rom. *Cæsarodunum*), a town of France, capital of the department of Indre-et-Loire, on the Loire; an important junction on the Orleans Railway. The Loire is crossed by suspension railway bridge and stone bridges, and there are several historic châteaux in the neighbourhood. Tours is an archbishopric, and there is a cathedral (St. Gatien), flanked by two towers, 205 feet high, a fine building begun in the twelfth, and completed in the sixteenth century. Of the twelfth- to thirteenth-century church of St. Martin of Tours only two towers remain. Manufactures include silk, cloth, carpets, and chemicals, and there is some printing, &c. Tours early became famous for its silk manufactures, and had a population of 80,000, when the revocation of the Edict of Nantes deprived it of nearly half its inhabitants, a blow from which it has never recovered. In 1870 Tours was the seat of the Government of National Defence. The town surrendered to the Germans on 21st Dec., 1870, and was occupied on 20th Jan., 1871. Pop. (1921), 75,096.

Tourville, De, Anne Hilarion de Cotentin, Comte, French admiral, born 1642, died 1701. He entered the navy in 1660, became captain in 1667, and vice-admiral in 1689. He defeated a Dutch and English fleet off Beachy Head in July, 1690, but in 1692 he was ordered to attack a far superior Dutch-English fleet off La Hogue, and was defeated. He was created marshal in 1693, and in 1694 destroyed a Dutch and English trading fleet off Cape St. Vincent.

Toussaint L'Ouverture (tö-saṇ-lö-ver-tür), a West Indian negro leader, born a slave in the Island of Haiti in 1743, died in 1803. After the insurrection of 1791 Toussaint served in the army of the blacks, and subsequently became their leader. He displayed great military and political ability, and in 1796 the French Government appointed him general in chief of the troops in Santo Domingo. After a severe struggle with insurrectionary movements he assumed supreme civil authority, and in 1801 was completely master of the island. He was appointed President for life of the Republic of Haiti, and under his vigorous government the commerce and agriculture of the island began to revive. But Napoleon did not choose to see him independent, although professedly loyal to France, and sent a powerful expedition to subdue Toussaint, who, after a vigorous resistance, was forced to surrender. He was sent to France, where he died in prison. There is a sonnet by Wordsworth entitled *To Toussaint L'Ouverture*.

Tower of London, an ancient fortress in London, consisting of a collection of buildings of various ages on a somewhat elevated position on the north bank of the Thames, outside the boundary of the old city walls. It covers about 18 acres, and is surrounded by a battlemented wall flanked with massive towers, and encircled by a moat. There is also an inner line of circumvallation broken by towers, and interspersed with other buildings. In the centre is the White Tower, the keep of the old fortress, around which are grouped the chapel, the jewel-house, barracks, and other buildings. The Tower was a first-class mediæval fortress, and served at once as a palace, a prison, and a place of defence. The White Tower was built by Gundulf, Bishop of Rochester, for William I in 1078. It was successively strengthened by various English sovereigns. The regalia, consisting of the royal crowns, sceptres, &c., are kept and exhibited in the jewel-house. The armoury contains a fine collection of armour and weapons. In the part called the Bloody Tower the two young princes, sons of Edward IV, were murdered. The Tower is now chiefly used as an arsenal, and has a small military garrison, which was considerably increased during the European War, when the Tower became a place of incarceration for political offenders. The Warders of the Tower (popularly known as Beefeaters) form a separate corps under the Constable. The Tower is governed by a Constable and Deputy-Constable.—BIBLIOGRAPHY: J. W. Bayley, *History and Antiquities of the Tower of London*; Lord Ronald Gower, *The Tower of London*; R. Davey, *The Tower of London*.

Town Council, the governing body of a borough or city. The council is elected by the rate-payers, and usually comprises three members for each ward of the borough or city. These hold office for three years. They elect their own chairman, who is known in England as the Mayor or Lord Mayor, and in Scotland as the Provost or Lord Provost. He is the chief civil functionary and municipal magistrate, and is ex officio a justice of the peace. The councillors also elect about one-fourth of their number (in the metropolitan boroughs one-seventh) as aldermen or, in Scotland, bailies, who rank next to the Mayor or Provost and are also magistrates. The council has charge of the local affairs of the borough or city, e.g. public health, police, roads, lighting, housing, &c., and has power to levy rates. It has a clerk, usually a solicitor, who holds office at its pleasure, and cannot be a member of it. He has charge of the records and attends to the business of the council. A councillor holds a fiduciary position, and cannot contract with the council of which he is a member.

Townshend, Charles, second Viscount, English statesman, born 1674, died 1738. He succeeded to the peerage in Dec., 1687, and took his seat as a Whig in the House of Peers in 1695. After acting as a commissioner for arranging the Scottish Union (1706), he was joint plenipotentiary with Marlborough in the conference at Gertruydenburg (1709), and then, as Ambassador to the States-General, signed the Barrier Treaty. For this he was censured by the House of Commons, and declared an enemy to the queen and kingdom. He thereupon entered into communication with the Elector of Hanover, who, on his accession as George I, appointed Townshend Secretary of State (1714). In 1717 he became Lord-Lieutenant of Ireland; and he was again Secretary of State from Feb., 1721, to May, 1730, when he retired on account of differences with his brother-in-law and colleague, Sir Robert Walpole.

Townshend, Charles, grandson of the above, born 1725, died 1767. He entered the House of Commons in 1747, and became a Commissioner of Trade and Plantations in 1749. He was a Lord of the Admiralty in 1754, member of the Privy Council in 1756, Secretary of War from 1761 to 1763, and Chancellor of the Exchequer in 1766. He supported Granville's Stamp Act (1765), and introduced the celebrated resolutions for taxing the American colonies (2nd June, 1767). From so often changing his political opinions he was known as the 'weathercock', but he had a great reputation for oratory and wit.

Townshend, Sir Charles Vere Ferrers, British soldier, born 1861, died 1924. He entered the Royal Marines in 1881, but transferred to the army, commanding the garrison of Chitral Fort during the siege (1895), for which he received the thanks of the Indian Government, and taking part in the Nile Expedition (1898) and the South African War (1898–1900). In 1909 he became brigadier-general, and in 1911 major-general. During the European War he was posted to the 6th (Indian) Division in Mesopotamia, and assumed command in April, 1915, almost immediately defeating the Turks at Kurna and Kut-al-Amarna. He was ordered to push on to Bagdad, and, in his march up the Tigris, he again defeated the Turks at Ctesiphon; but the weakness of his force compelled his retirement upon Kut, where his force was beleaguered for 143 days, and eventually capitulated owing to starvation and disease. General Townshend himself remained a prisoner in Prinkipo Island until Oct., 1918. In Nov., 1920, he became Independent member of Parliament for The Wrekin, and joined the Conservatives during 1922. He received the K.C.B. (1916), and resigned from the army in 1920. See *European War (Mesopotamian Campaigns)*.—Cf. his book *My Campaign in Mesopotamia*.

Townsville, a seaport of North Queensland, Australia, on Cleveland Bay, a terminal of the North Queensland Railway. As the port of an immense territory, including a large area of pastoral country, there is a large shipping trade. Pop. 18,835.

Towton, a village of England, in Yorkshire, 3 miles south-east of Tadcaster. Towton is noted as the scene of a battle between the Yorkist forces under Edward IV and the Earl of Warwick and the Lancastrians in 1461. The latter were completely defeated. See *Edward IV*.

Toxicology is the science which deals with the effects of doses of drugs large enough to endanger life, and is a subdivision of the science of *pharmacology*, which treats of the actions of drugs on the body both in health and disease. In practice, however, this definition is too narrow, and must be extended to cover all substances which endanger human life, as drugs, chemicals, irrespirable gases, foods, and vegetable and animal products. Toxicology has been pithily described as the science of poisons, and this is perhaps as good a definition as any. A poison has been defined as " any agent capable of producing a morbid or dangerous effect upon anything endowed with life "; in the narrower medico-legal sense " a poison is a substance which, if applied to the body or administered internally, has been applied or administered with the *intention* to kill or do harm ".

Mode of Action of Poisons.—Poisoning may be *acute* or *chronic*. The chronic type is the more instructive and will be considered first, *chronic arsenical poisoning* being taken as an example. When arsenic, i.e. arsenious anhydride, is administered in small doses by the mouth, it is absorbed in solution from the gastro-intestinal tract and passes into the blood, which carries it to all parts of the body. Elimination begins at once, and takes place by all the excretory channels, viz. by the urine, fæces, sweat, tears, saliva, &c. As elimination is slow, there is a tendency for the substance to accumulate in the tissues of the body—a fact of great medico-legal interest, as the bodies of those who have died from chronic arsenical poisoning preserve their life-like appearance for a long time, owing to the preservative property of the arsenic taken. Arsenic having decided toxic properties, it is obvious that it will exert them more or less in all the tissues of the body; thus it is excreted by the gastric and intestinal mucous membranes, and great hyperæmia is induced, which is an irritant effect. As a result there is nausea, pain in the epigastric region, sickness and vomiting, and diarrhœa alternating with constipation; the nutrition of the body is impaired, with consequent loss of weight; in the same way there is a catarrhal condition of the mucous membranes of eyes, nose, and mouth. The skin also is affected, for the natural pigmentation is remarkably increased, the lower part of the abdomen, for example, becoming yellowish-brown; while there is irregular growth of the nails and falling out of the hair. The nervous system is also involved, a peripheral neuritis being indicated by loss of sensation in the hands and feet and loss of power of movement, shown at one stage by wrist- and foot-drop. Post-mortem examination of the principal organs, i.e. stomach, liver, kidneys, heart, &c., shows widespread fatty degeneration, while chemical analysis reveals arsenic in greater or less quantity in all the organs most affected. The fatal result following prolonged administration of overdoses of arsenic is due to widespread pathological changes and not to a localized effect. The form in which the arsenic is administered is of little importance provided it is absorbed; even the gaseous diethylarsine evolved from damp arsenical wall-paper under the influence of fungi produces a chain of symptoms similar to those described.

Chronic poisoning by salts or preparations of lead, mercury, copper, antimony, tin, or zinc, or by phosphorus, ergot, morphine, cocaine, &c., is well known; and as each of these substances produces its own peculiar set of symptoms, it is possible for the physician to make a shrewd guess as to the nature of the poisonous material from the symptoms of the patient and, in certain cases, from the nature of his employment. In certain vocations the workers are medically examined at definite intervals, and when a case of industrial poisoning is found, notification is compulsory under the Factory and Workshop Act, 1895; in addition, processes are modified to eliminate industrial poisoning, as in the production of leadless glazes, and matches with red instead of yellow phosphorus.

Acute poisoning follows the administration of large doses of poisonous substances, and is frequently the event in chronic poisoning which leads to the detection of the latter. The effect is usually (1) local and (2) remote. The local effect may be that of a corrosive or an irritant. The corrosive effect is seen in the widespread destruction of the tissues which results when sulphuric acid is applied to the skin or to a mucous membrane, as in the act of swallowing; the symptoms come on at once after swallowing, and consist of burning, agonizing pain in the mouth, throat, gullet, and stomach, with continuous retching and vomiting of shreddy blood-stained material; intense thirst is present, and often the air-passages are involved. The mind is clear; death may occur early, and be due to ' shock ', or the destruction of the tissues may result in suffocation from involvement of the larynx, or in death from perforation of the stomach. Recovery may take place after such a ' burn ', the necrotic tissue being thrown off and replaced by cicatricial tissue; this contracts, obliterating more or less the lumen of the œsophagus and stomach, so that death frequently follows weeks or months later from starvation.

The local irritant effects ensue at a variable time after a poison has been swallowed, usually from a half to one hour later. The gastro-intestinal tract is inflamed, the inflammation passing to ulceration, and giving rise to severe pains in the abdomen, with violent continuous vomiting and diarrhœa. Thirst is very intense, and drinking does not quench it but induces more vomiting. Death may be due to shock or collapse; the pulse becomes thready and irregular, and the skin clammy and cold; cramps may occur in the muscles of limbs; the mind, which has been clear, becomes clouded, and unconsciousness with or without convulsions ushers in the end. The fatal termination may be delayed, and is then usually due to the 'remote' action of the poison taken or to the *sequelæ* of inflammation of the gastro-intestinal tract.

The remote action of a poison occurs after absorption from the stomach and intestines, and this applies whether there has been any local action or not. The narcotics, for example, may cause little or no local reaction in the gastro-intestinal tract, and are all the more dangerous on that account. Once in the blood-stream, the poison may act in many ways. Chloroform, chloral hydrate, morphine, alcohol, &c. (the narcotics), depress the whole functions of the brain and spinal cord, and when the centres in the *medulla oblongata*, which control the muscles of respiration and the heart itself, are depressed sufficiently, death ensues. Hydrocyanic (prussic) acid attacks these centres very quickly, causing almost instant death. Strychnine acts on the motor cells of the anterior cornua of the spinal cord, making them so sensitive to incoming or afferent stimuli that the whole musculature of the body passes into a sustained spasm, so that respiratory and cardiac movements are impossible, and death ensues. Substances such as potassium chlorate, nitrites, and carbon monoxide attack the blood itself, the former converting the hæmoglobin of the blood into met-hæmoglobin, while the other two form addition products, the net result in each case being that the normal oxygenation of the blood fails and death follows. Other substances, such as digitalis, act on the heart.

Treatment of a Case of Poisoning.—From the foregoing it is evident that the treatment of a case of poisoning is essentially twofold: (1) local, to prevent or limit absorption; and (2) general, to combat the effects after absorption.

Local Treatment.—This consists in removing the noxious material as far as possible by encouraging vomiting or by washing out the stomach, while at the same time administering an antidote to neutralize the poison, or to convert it into an insoluble compound which can no longer be absorbed and may be removed by lavage. Vomiting may be induced by tickling the fauces with a feather or with the finger; it is better to give an emetic such as a solution of common salt, two tablespoonfuls dissolved in half a tumblerful of tepid water, or twenty grains of sulphate of zinc, or one-tenth of a grain of apomorphine hydrochloride hypodermically. If these fail, an improvised siphon tube can be made with about 5 feet of strong rubber tubing about half an inch in diameter, and marked 20 inches from one end by a thread of worsted, while the other end carries a funnel of glass or metal; the lower end of the tube is placed in the mouth and pushed onwards until the back of the throat is reached, then the point is moved downwards by the finger placed above, and the tube pushed onwards until the worsted mark is in contact with the teeth. The lower end of the tube is now in the stomach, and it is an easy matter to introduce 2 pints of warm water, containing the antidote selected, by raising the funnel-bearing end of the tube above the patient's body and pouring the fluid into the funnel; by depressing the funnel to a point lower than the patient's stomach, taking care to pinch the rubber tube close to the funnel while it is yet full, and when it is in the lowest position releasing the pressure, the fluid introduced siphons off, carrying with it more or less of the deleterious material. The process is repeated frequently until the fluid introduced returns unchanged. The stomach pump is essentially the same as the siphon tube, but has as an addition a bulb with valves to regulate the flow. This is the process known as 'lavage'. In those cases in which vomiting is well established, the patient is encouraged to drink water containing the antidote in the intervals between the attacks of vomiting. When it is obvious that no more foreign material is being removed, demulcent drinks of milk, egg-flip, or barley water may be given, and, after narcotic poisoning, stimulants such as tea, coffee, and weak spirits may be administered.

Antidotes.—The use of an antidote presupposes that the nature of the poison is known, otherwise one must go on general principles, using emetics and lavage as the case may be. This is particularly true of poisoning due to organized substances such as laburnum pods, belladonna, yew berries, aconite root, or tainted foods, animal or vegetable; as well as to that due to narcotics like alcohol, chloroform, chloral hydrate, sulphonal, &c. In many instances, however, the poison is known either by name or by its effects. The best antidote in cases of poisoning by corrosives generally, such as mineral and organic acids, with the exceptions of oxalic and carbolic acids and mercuric and zinc chlorides, is calcined magnesia (MgO) mixed with water to form a thin milk-like fluid; in the absence of this substance, sodium bicarbonate (baking soda) in the proportion of a tablespoonful to a tumblerful of warm water may be used freely, or calcium carbonate in the form of 'whiting', chalk, or tooth powder may be used in the same manner as magnesia. For oxalic acid and oxalates (salt of sorrel), calcium carbonate is the only antidote. Carbolic acid and its homologues and preparations, as cresol, lysol, creolin, &c., do not react like ordinary acids to alkalies, with the result that milk, and white of eggs switched with milk or water, are the most efficient antidotes, followed by lavage; later, one may give sodium or magnesium sulphate well diluted with water to promote elimination. Soluble lead and barium salts have an efficient antidote in magnesium or sodium sulphate, while arsenic in solution is precipitated by a mixture of tincture of steel (perchloride of iron), water, and calcined magnesia. Strong alkalies, as caustic potash and soda, are neutralized by cream of tartar and lime juice, and this applies to a certain extent to ammonia solution, the most urgent symptoms of which are, however, respiratory rather than gastric. Poisoning by opium and its derivatives morphine and laudanum is treated by lavage with water coloured pink with potassium permanganate, while phosphorus poisoning due to matches or rat paste is treated in the same way or with very weak 'Sanitas'.

General Treatment.—This is threefold, and consists of: (1) the use of physiological antidotes when these are possible, (2) the improvement of elimination from the body by all the natural channels, and (3) the treatment of 'shock' and other dangerous and urgent symptoms as they arise.

The use of physiological antidotes is very limited; thus in opium (inclusive of morphine and laudanum) poisoning, the depression of the central nervous system may be combated by strong tea and coffee (i.e. caffeine); strychnine is overcome by chloroform anæsthesia or large doses of chloral hydrate, both of which depress the functions of the brain and, later, that of the cord; belladonna and atropine by morphine injections; the object in all cases being to prolong life that natural elimination processes may take effect. Improvement of elimination is obtained by rectal lavage, subcutaneous saline injections, and the use of hot packs. Urgent symptoms, such as 'shock', require the application of heat and the use of stimulants, and failure of breathing calls for artificial respiration to tide over, if possible, the critical period.

The action of a poison is modified by many circumstances. (1) *Quantity.* It is not legitimate to conclude that a large quantity of a poison is more likely to have a greater effect than a small quantity. It is true to a certain extent, but large allowances have to be made. The large quantity may induce severe vomiting and diarrhœa, and thus be expelled from the system, while the smaller quantity may be mostly absorbed; thus 10 grains of tartar emetic have killed a boy of five, while recovery has followed 60 grains. (2) *Chemical combination* is of great importance, for it is on the fact that certain compounds of a given poison are non-poisonous that the use of antidotes is based. Potassium cyanide, a virulent poison, can be converted into harmless potassium ferrocyanide by mixing it with ferrous sulphate and an alkali; morphine is oxidized to a harmless derivative by potassium permanganate; and heavy metals, as lead, silver, and copper, can be changed into insoluble salts, as sulphate, chloride, or ferrocyanide, and so rendered harmless. (3) The *part of the body* to which the poison is applied has a great influence on the rapidity of its action. Inhalation of a poison, as a gas or vapour, allows its action to be most rapid, for absorption into the blood of the lungs takes place at once. Intravenous injection acts with equal rapidity; subcutaneous injection, as of morphine, is somewhat slower in its effect; and following this we have absorption from mucous surfaces, as the gastro-intestinal tract, the nose and body passages, and lastly the broken and unbroken skin. Certain substances have no poisonous effects when taken by the mouth, and only exhibit their characteristic action when injected subcutaneously, examples being snake venom and adrenalin. (4) *Habit.* Those accustomed to the use of a drug acquire a degree of tolerance or immunity. Striking examples of 'habit' are seen in morphomaniacs, who often take 6 to 10 grains of morphine hydrochloride per day without experiencing any ill effects. (5) *Condition of health.* Debilitated individuals are more susceptible to the influence of poisons than healthy people. There are many exceptions, e.g. diabetics can take much larger doses of morphine and alcohol than normal individuals, while in mania from any cause the amount of sedative substances, such as chloral hydrate and hyoscine, which can be borne without apparent effect is most surprising. (6) *Idiosyncrasy.* This is a peculiar intolerance which is shown by many individuals to very small doses of drugs which normally produce no ill effects; 2 grains of calomel have produced all the symptoms of mercurial poison, while 10 grains of sodium salicylate have produced a widely diffused pustular eruption.

The Chemistry of Poisons.—As cases of poisoning in many respects resemble natural disease as regards onset and clinical signs, it becomes necessary to apply most vigorous physical, chemical, and physiological tests to the vomit, contents of the stomach, and to certain organs, as the stomach itself, liver, kidneys, &c. Inspection of the vomit or the stomach contents will reveal poisoning by cantharides (the green wing-cases of which are characteristic), croton and castor seeds, apricot kernels, and aconite root, while the sense of smell will cause the detection of phosphorus and cyanides—including hydrocyanic acid and seeds which yield this substance on maceration—laudanum, alcohol, carbolic acid, &c. In most cases, however, the poison requires to be separated and identified by its physical appearance and by chemical tests; this is a matter for analytical chemistry, and need not detain us here. Dealing with alkaloids such as morphine, strychnine, atropine, and cocaine, the quantity obtained by the analyst may be so small as to prevent its recognition by physical characteristics. Recourse must then be had to experiments on animals. Strychnine, for example, can be recognized by its action on frogs, and atropine by its action on the eye of a cat; these physiological and chemical tests combined are conclusive, though either group by itself may be most unsatisfactory.

The examination of tainted foods, both animal and vegetable, is chiefly bacteriological. Foods prepared by heat and preserved in hermetically sealed tins and jars are liable to ferment or undergo less obvious changes on storage. The sterilization has been inefficient in such cases, the *spores* of many bacteria resisting the action of heat for a long time, although the free bacteria are all killed in the process. On storage, however, the spores develop, and if the bacteria are anaerobic, i.e. can live in the absence of air, the food in course of time is badly infected. Various substances are produced by the action of these bacteria - gases, giving the so - called 'blown' tins, and toxins or substances of an albuminoid nature, which may have a very poisonous effect on the human subject, causing severe gastro-intestinal disturbances, and at times death. Two organisms are usually associated with tainted foods, viz. bacillus botulinus and bacillus enteritidis of Gaertner. The former is anaerobic, and produces a toxin of intense virulence acting on the central nervous system and causing dilatation of the pupils with loss of vision, diplopia, and general paralysis, ending in death ('botulismus'); the latter is found in foods exposed to the air, and its toxins cause severe vomiting and diarrhœa, with death from a form of septicæmia. What is popularly called 'ptomaine poisoning' is therefore bacterial poisoning, due to the growth of organisms in the food consumed, as sausages, ham, pork, corned beef, &c. Shell-fish poisoning is doubtless similar in origin, although the work of Brieger and others points to another conclusion. See *Bacteriology*; *Preserved Foods*.

Poisoning by Irrespirable Gases.—The hydrogen compounds of arsenic, antimony, and phosphorus are very poisonous, as their absorption into the blood from the lungs is exceedingly rapid. The same is true of sulphuretted hydrogen, carbon monoxide, and carbon dioxide, the two last being the cause of the commonest forms of gaseous poisoning. The treatment in every case is transference of the patient to the fresh air, and thereafter the use of stimulants, hot packs to promote elimination, and artificial respiration when signs of failing respiration appear. The condition of the blood in two of these forms of poisoning has already been referred to. During the European War irrespirable gases were used on a very large scale. At first they consisted of gases which had an irritant action on the tracheal and bronchial mucous membrane, causing acute bronchitis, emphysema, and pneumonia, which frequently had a fatal issue; at a later date the gases were often merely vapours which condensed to liquid upon the clothing and skin of the combatants, setting up forms of generalized irritation which often proved fatal. See *Poisonous Plants*; *Poison-gas Warfare*.

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Toynbee Hall, a London University settlement located at 28 Commercial Street, Whitechapel, E1. It was opened in Dec., 1884, as a memorial to Arnold Toynbee (1852–83), the British economist, who was educated at Pembroke and Balliol Colleges, Oxford, and who devoted his life to the amelioration of the social condition of the poor, especially in the east end of London. The Hall is of the nature of a residence, where university men can follow in the footsteps of the founder.

Trachea (trā'kē-a), or **Windpipe**, in anatomy, the name given to the tube extending from the larynx (q.v.) down into the chest to a point opposite the third dorsal vertebra, where the tube divides into two chief divisions or bronchi (q.v.), one of which supplies each lung with the air necessary for respiration or breathing. The trachea in man is of cylindrical form, about 4½ inches long, and from ¾ to 1 inch in diameter, and is composed of from sixteen to twenty rings or zones of gristly or cartilaginous nature, separated and connected by fibrous tissue. Each cartilage forms an imperfect ring, being unclosed behind, and having the gristly edges merely joined by fibrous membrane. The windpipe is lined by delicate mucous membrane which is covered by epithelial cells provided with delicate vibratile processes or *cilia*. All mammals, reptilia, and birds possess a trachea, but some amphibia want this organ, the lungs in such cases springing directly from the larynx.

Tracheotomy, a surgical operation to establish breathing through an opening in the wall of the trachea, is called for when there is serious obstruction to respiration by way of the natural air-passage at a higher level. Diphtheria, certain forms of laryngeal inflammation and paralysis, œdema, and tumour in the larynx or pressing upon it from without are among the pathological conditions which cause such obstruction. The operation is also performed in other circumstances, e.g. as a preliminary to operations which might otherwise involve the inhalation of blood or infected material. The surgical procedure adopted is known as *high* or *low* tracheotomy according to its site, either above or below the isthmus uniting the two halves of the thyroid gland across the middle line of the neck. A *tracheotomy tube* is used to maintain the patency of the opening made into the lumen of the trachea.

Trachyte (trā'kīt), a compact volcanic rock, breaking with a rough surface, and containing some 65 per cent of silica. The term is now limited to rocks intermediate between rhyolite and andesite. Large crystals of clear orthoclase often occur, with soda-augite, hornblende, or biotite.

Tracks, Railway. The permanent way in general use on the railways of Great Britain is of the chaired type, consisting of steel bullhead rails supported by, and keyed into, cast-iron chairs secured to wood sleepers. The gauge, or distance between the inside edges of the rails, is 4 feet 8½ inches, this distance usually being very slightly increased on sharp curves. The rails vary in weight from 80 lb. to 100 lb. per yard, depending upon the nature and density of the traffic. The length of the rails also varies from 30 feet to 60 feet, but the latter length is exceptional, 45 feet rails being most commonly used. The weight of the cast-iron chairs ranges from a minimum of 38 lb. to a maximum of 56 lb. On some railways it is the practice to use a heavier chair in conjunction with a larger sleeper, on either side of each rail joint, for the purpose of giving it additional support. The keys or wedges used for securing the rail in the jaws of the cast-iron chairs are usually cut from oak or teak. Keys made of steel are also in use to a limited extent, and are of value in preventing ' creep ', or forward movement of the rails under traffic. The rails are connected at each joint by means of two rolled-steel fishplates and four fishbolts. Various methods of fastening the cast-iron chairs down to the sleepers are in use, such as bolts passing right through the sleeper, with the nut either on the under side or top; heavy coachscrews; or wrought-iron spikes used in conjunction with oak trenails, two spikes and two trenails being used to secure each chair. The ordinary sleepers are 8 feet 6 inches or 9 feet long, 10 inches wide, and 5 inches deep, and are usually cut from Baltic redwood. Before being laid in the track they are impregnated with creosote oil, the general practice being to force about 2½ gallons into each sleeper under pressure. The spacing of the sleepers in every rail-length varies, the normal distance apart decreasing near the joint, where the rail is weakest.

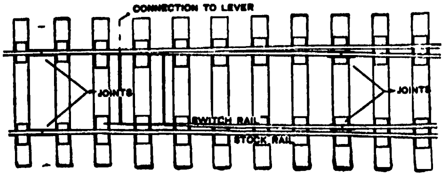


Fig. 1

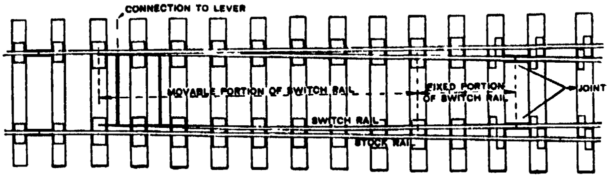


Fig. 2

Switches and Crossings.—The general design of the switches and crossings does not vary to any appreciable extent, the differences being in such details as the planing of the switch rails, and in the design of the heavier chairs which are used for this class of work. The switches in use may be classified generally under two heads, ' heel ' switches and ' heelless ' switches. In the former, the heel of the planed or tapered movable switch rail is connected to the turnout rail by means of two fishplates, this movable switch rail being more or less free to pivot about the joint (fig. 1). In the heelless type of switch a longer rail is used in the manufacture of the movable switch rail, but it is rigidly fixed by means of suitable chairs from a point approximating to the joint at the end of a heel switch (fig. 2). The ' spring ' of the switch rail is sufficient to allow the tapered end to move freely without risk of fracture. The advantages of heelless switches are increased support to the switch rail and improved running due to the continuity of the rail. The tendency of modern practice is to favour the use of heelless switches exclusively. In each pair of switches, the two switch rails are connected across the four-foot by means of stretcher rods, the length of which is regulated so that when the tapered portion of one switch rail is against the stock rail, there is a space of about 4 inches between the opposite switch and stock rail, to allow the wheel flanges to pass. This dimension of 4 inches constitutes the 'travel' of the point of the switch rails when moved over from one position to another. Crossings in general use are of two kinds, common or 'V' crossings (fig. 3) and obtuse or 'K' crossings (fig. 4).

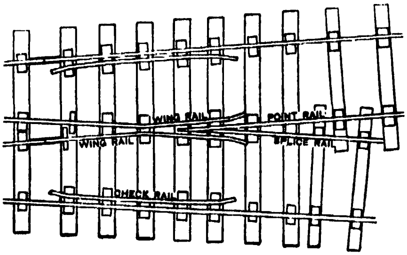


Fig. 3

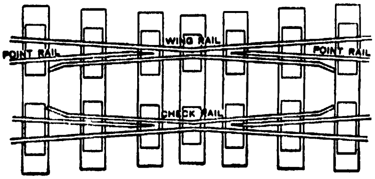


Fig. 4

The flattest crossings in ordinary use are 1 in 16 in the case of common, and 1 in 8 in the case of obtuse. Obtuse crossings with movable point rails worked on the same principle as switches are in use to a limited extent (fig. 5). This type of obtuse crossing eliminates the danger of wheel flanges striking the end of the point rails and causing derailment, and also gives smoother running owing to the continuous rail surface. A further, and perhaps greater, advantage is that it can be made flatter than the ordinary obtuse crossings, and is therefore of the greatest use in fast-running junctions where it is necessary to get the maximum radius of curve. Common crossings having a movable wing rail which is held in its normal position by a spring are also used to a limited extent, the object of this design (fig. 6) being to provide a continuous surface for the wheels when travelling along the main line, in order to minimize shock. These are known as spring crossings.

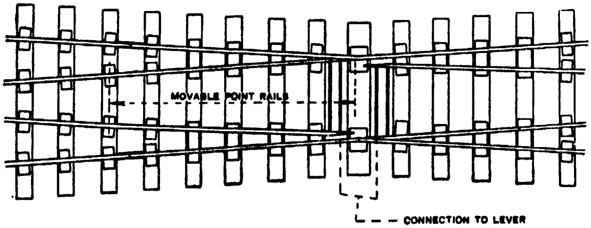


Fig. 5

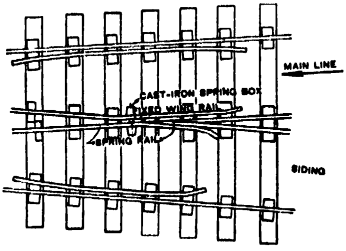


Fig. 6

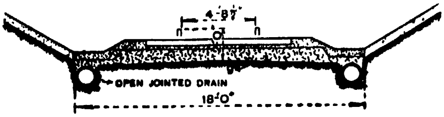


Fig. 7

The essentials for a good permanent way are a solid foundation and efficient drainage, good ballast, sound design of component parts of the track, and efficient maintenance.

Before the permanent way is laid down, the ground is carefully levelled or graded to a fixed distance below the level at which the rails are to stand, the surface being cambered to allow the water percolating through the ballast to find its way quickly into the side drains. After this is completed, a layer of bottom ballast of rough stone or other suitable material is laid down, and on top of this a thinner layer of finer ballast, such as gravel, broken stone, slag, or cinders, is placed to form a medium for the final adjustment of rail level, and also to ensure an even bed for the sleepers (fig. 7).

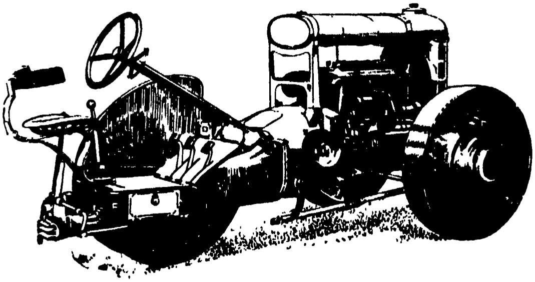
Where the permanent way is curved, vehicles travelling along it exert a side pressure on the outside rail, and in order to counteract this the track is canted or 'super-elevated' where possible, the amount of this super-elevation, the maximum of which is about 7 inches, being determined usually by the maximum speed at which trains pass round the curve.

Tractarianism. See *Oxford Movement.*

Tractors, a term originally applied to mechanically propelled vehicles used for haulage purposes, but now generally restricted to vehicles driven by internal-combustion engines. The application of the tractor to agricultural operations began in the latter part of the nineteenth century, when heavy traction steam-engines were used for ploughing and cultivating. Experiments to replace the steam-engine by a lighter and more mobile internal-combustion engine, suitable for moving with the implements, resulted in the evolution of the modern tractor. During the European War, specially rapid strides were made in improving it, so much so that the outfit of the large up-to-date farm is incomplete without it. The tractor essentially consists of an internal-combustion engine set on a metal wheel-bearing frame, or *chassis*, which the former propels through the agency of a device for transmission of power, the speed and direction of motion both being controllable. The *engine* works on the Otto cycle, and may have one, two, or four cylinders, arranged in the last-named type either in a lengthwise direction behind each other or in a crosswise direction with respect to the longest axis of the machine. Two or four cylinders give a more even torque and therefore less vibration. The necessary ignition to explode the gaseous charge in the cylinders is provided by a high-tension magneto, driven from the engine shaft by a chain or spur gear. Either petrol or paraffin can be used as fuel, but most types are suited to starting on petrol and working on paraffin by means of a modified carburettor, a device for vaporizing the fuel. Engine-cooling is effected by the pump radiator circulation method, in which water is circulated by pumping from a radiator through a series of pipes or by the thermo-siphon principle, aided by a rapidly revolving fan, as in certain types of motor-cars. Lubrication is best carried out on the forced-feed principle.

Transmission gear is necessary to transfer the power liberated at the engine to the driving wheels, and as it must be so constructed as to reduce the speed from the 800 to 1000 revolutions per minute of the engine to a wheel speed of roughly 3 to 4 miles per hour, it takes the form of a system of spurred gearing. A gear box is provided for varying the speed or for reversing. To allow of the engine shaft being disconnected from the transmission gear so that the mechanism may be started or the engine run while the machine is stationary, a clutch is fitted. Differential gear, permitting one of the driving wheels to travel more rapidly than the other, as happens in turning, is fitted to the back axle. The drive is communicated to this axle in most cases; in three-wheeled machines, however, each wheel is driven direct from the gear box. In order that the tractor may do stationary belt work, a belt pulley is also attached to the gearing.

Chassis.—The steel framework may be provided with either three or four wheels; in the former and less common case, the odd wheel may be either behind or in front. Propelling wheels vary from 3 to 5 feet in diameter by 10 to 12 inches in width, while front wheels measure from 2½ to 3 feet in diameter by 6 inches in width. They are provided with detachable projections, called 'spuds', for use while working on the land. In some instances caterpillar wheels (similar to 'tank' wheels) are provided. The steering device usually takes the form of a worm gear.



Tractor. By courtesy of Messrs. Wallace (Glasgow), Ltd.

The power of tractors varies between 10 and 30 b.h.p., the weight from 17 to 50 cwt., and the length from 8 to 12 feet. The speed can usually be varied from 1½ miles per hour to about 5 miles per hour. The tractor is a most adaptable unit in farm machinery. It can be used for hauling tillage implements and harvesting machines, for road haulage work, and for such stationary work as threshing, sowing, and chaff-cutting. Its greater power allows of its drawing larger implements than ordinary farm horse teams, so that more work may be carried through in a limited time. As success in farming largely depends upon making the best possible use of favourable weather conditions, the tractor proves invaluable to the farmer in sowing an increased acreage under ideal conditions and harvesting it again as desired. The actual increase in the value of the produce due to the use of the tractor is not easy to estimate, but it must be taken into account when the tractor is compared with other forms of power from the point of view of economy.—Cf. *Agricultural Machinery Review.*

Trade Boards, Boards, consisting of an equal number of representatives of employers and employed and of a small number of nominated members, established by the Trade Boards Act, 1909, their duties being to consider industrial conditions and to fix minimum rates of wages in certain industries, and to vary or cancel these rates from time to time. The industries covered by the Act were tailoring, box-making (cardboard and the like), machine-made lace-finishing, and chain-making; but in 1913 the confectionery-manufacturing, food-preserving, shirt-making, hollow-ware making, embroidery-manufacturing, and laundry trades, and in 1919 the milk-distributing trade, were brought within the scope of the Act. Formerly under the Board of Trade, these Boards were transferred to the Ministry of Labour in 1917. Employers must pay at least the minimum rates clear of all deductions, under a penalty not exceeding £20 for each offence and £5 for each day on which the offence is continued after conviction. No agreement in contravention of the Act is valid. The Act was amended in certain respects in 1918.

Trade Disputes Act, an Act of Parliament passed in 1906 to alter the law laid down by the House of Lords in 1901 in the Taff Vale case and in other decisions that a trade union was liable in damages for acts which were committed by its officials within the scope of their authority, and for which private persons would be so liable. The Act, therefore, puts trade unions in a privileged position by enacting that certain acts which otherwise would be illegal under the law of conspiracy are not to be actionable if done in pursuance of a trade dispute. ‘ Peaceful picketing ’ is legalized by a provision permitting persons acting for themselves or for a trade union or employer to attend at a person's place of residence or business for the purpose of ‘ peacefully persuading ’ him to work or abstain from working. To induce another person to break a contract of employment, or to interfere with another's trade, business, or employment, or with another's right to dispose of his capital or labour as he pleases, if done in furtherance of a trade dispute, is no longer a breach of the law; nor can a court of law entertain any action against a trade union or its members or officials for any tortious act committed by or on behalf of the union. Whatever the merits of the Act, much controversy has raged around it, and its provisions have frequently led to abuses.

Trade-mark, " a mark used upon or in connection with goods for the purpose of indicating that they are the goods of the proprietor of such trade-mark by virtue of manufacture, selection, certification, dealing with, or offering for sale ". The law applicable to trade-marks in the United Kingdom is contained in the Trade Marks Acts, 1905 to 1919. A register is kept at the Patent Office, the Registrar being the Comptroller-General of Patents, Designs, and Trade Marks. In order that a trade-mark may be registrable, at least one of the following particulars is essential: (1) the name of a company, individual, or firm used in a special manner; (2) the signature of the applicant for registration; (3) an invented word; (4) a word not geographical, not a surname, and not having reference to the character or quality of the goods; and (5) a distinctive mark or device. All applications for registration are advertised, and any person may oppose the registration. Registration is for a period of fourteen years, but is renewable from time to time for a further term of fourteen years. An infringement of an unregistered trade-mark not in use prior to 13th Aug., 1875, does not carry any liability for damages. See *Merchandise Marks Act.*

Trade Protection Societies. When the industrial revolution destroyed the old associations of merchants and the trade guilds, commercial men soon realized the necessity of replacing these organizations by others capable of protecting their interests under the new conditions. In Great Britain commercial associations were formed during the last quarter of the eighteenth century in Birmingham, Exeter, Halifax, Leeds, Liverpool, and Manchester, without any assistance or interference from the State. Out of these has sprung the network of chambers of commerce, general associations, institutes representing particular trades and trade protection societies, which is now spread over the industrial areas of the country. Organizations of the group last named represent retail as well as wholesale traders, and supply information as to the credit of firms, collect debts, and seek in various ways to promote trading interests. There are over a hundred trade protection societies in the United Kingdom, of which one of the most powerful is the Manchester Guardian Society, with over 6000 members. The objects of this society, which may be taken as typical of the whole group, are: the making of private inquiries as to the respectability and credit of traders; the detection and exposure of swindlers; the collection of debts; the winding-up of insolvent estates; the issue of notices of bills of sale, judgments, bankruptcies, &c.; and generally the improvement of laws and regulations affecting trade. The society is said to answer about 40,000 credit inquiries every year.

Tradescantia, a genus of lily-like plants, nat. ord. Commelinaceæ. The species are natives of America and India, and many of them are cultivated as ornamental plants in flower-gardens. They are well marked by three sepals, three petals, three-celled capsule, and filaments clothed with jointed hairs. *T. virginica*, a North American species, is known by the name of *spiderwort*. It has succulent stems, shining grass-like leaves, and blue or purple flowers, and it is common in the flower-borders of English gardens.

Trade Unionism. The trade union is essentially a product of the modern industrial system; although associations of workpeople for mutual assistance and protection have existed since early times, the modern type of trade union does not date back farther than to the eighteenth century, i.e. to the beginnings of the industrial revolution. A trade union may be defined as any group of persons who sell their labour power to others for a wage or salary, and who combine in a permanent organization to protect their joint interests by a common policy. Throughout the nineteenth century the British wage-earners had to fight a hard battle to secure the right to combine, and to use the power thus gained to improve their position. The combination laws pressed heavily upon them, and even when the stringency of their provisions had been somewhat relaxed, the judicial interpretation given to such phrases as ' peaceful picketing ' continued to deprive the trade union in great measure of effective operation. Complete victory was finally attained by the Trades Disputes Act of 1906, which legalized picketing and similar methods of action, and, above all, protected union funds from being sued.

Trade Union Organization.—By the end of the nineteenth century the trade union movement in England had become crystallized in a fairly definite form. The ' craft ' or sectional union was the main type of organization, and unions existed in most branches of skilled workers. In recent years ' industrial unionism ', or the amalgamation of most of the separate unions of each industrial group into one large union, representing the whole of labour in that group, has come increasingly into prominence, and the trend of development appears to be in this direction. At the same time, the growth of trade unionism amongst unskilled workers, and the very active part played by labour organizations in politics, are very characteristic of present tendencies. ' Direct action ', or the attempt to carry through fundamental modifications in the industrial and political structure of the country by the use of the strike on a great scale as an offensive weapon, appears to be repugnant to the mass of British workers, and to the policy of organized labour as a whole.

Trade Union Method.—The essence of trade unionism is the use of combination to remedy that inferiority in bargaining power which is bound to arise if the worker deals as an isolated unit with the employer. Part of the strength of the trade unions arises from their ability to collect considerable sums of money from their members for the provision of out-of-work and similar benefits which mitigate the effects of unemployment; these funds provide the reserve which is indispensable if the union is to carry out its policy. The trade union seeks to arrive at a collective agreement with the employer or group of employers as to rates of wages, hours of labour, working conditions, &c. If no agreement can be come to, recourse may be had to conciliation, and frequently provision is made for the submission of disputes to arbitration. In the last resort the issue may have to be decided by a trial of strength between the two parties, i.e. by a strike or lock-out. The aim of collective bargaining is to secure a ' common rule ' in regard to wages, hours, &c., which will prevent the unscrupulous employer from dragging down the whole standard of an industry, and will secure to an average worker a living and, if possible, progressive wage under conditions that will protect him from being over-driven and worn out at an early age. Much of the opposition of the trade unions in some industries to piece-work, and many customary rules which undoubtedly affect and restrict output, are due to this last consideration, and to the fear, based on past experience, that piece wages are liable to be ' cut ' if under their stimulus the amount of work turned out in a given time is largely increased. It is in the removal of these apprehensions, and in the future safeguarding of labour from the evil effects of unemployment, that so much yet remains to be done in order that trade unions, besides exercising their normal functions of protecting the interests of the workers, may throw their great influence into the scales on the side of greater efficiency and productivity in industry as a whole.

Influence of Trade Unions on Wages.—The direct influence of trade unions on wages is more apparent in the short than in the long run. When trade is improving and profits rising, trade unions can secure higher wages more quickly than they would have been brought about by the force of competition among employers, while in times of falling prices, they can interpose a somewhat longer resistance to wage reductions, and can hinder the competitive cutting of wage rates. In view of the importance, though within rather narrow limits, of bargaining in the determination of wages, it is probable that trade unions are able to keep money wages a little higher than they would otherwise have been. But in the longer run, no trade union can compel employers to pay higher wages to their workers than they are worth to them. After a certain point has been reached a reduction in employment will be inevitable, though this is likely to occur to a less extent in so far as the employer can transfer the burden of high wages to the consumer of the goods produced. But as the whole body of wage-earners themselves constitute the bulk of the consuming power, rises in wages forced by strong trade unions may turn out to be largely at the expense of other sections of labour.—BIBLIOGRAPHY: Sidney and Beatrice Webb, *Industrial Democracy*; G. D. H. Cole, *The World of Labour*; A. C. Pigou, *Principles and Methods of Industrial Peace*.

Trade Winds. See *Geography* (section III: *Climate and Weather*); *Monsoon*.

Trafalgar, a low and sandy headland on the south-west coast of Spain, at the western entrance to the Strait of Gibraltar. The famous naval battle in which Nelson defeated a larger French and Spanish fleet under the command of Villeneuve and Gravina was fought on 21st Oct., 1805. The Franco-Spanish fleet lost 15 ships out of 33 in the actual battle; the British losses were nil, and in personnel amounted to only 449 killed.

Trag'acanth, a variety of gum familiarly termed gum-dragon or gum-tragacanth. It is the produce of several species of the genus Astragălus, leguminous plants, natives of the mountainous regions of Western Asia. In commerce tragacanth occurs in small twisted thread-like pieces, or in flattened cakes, in colour whitish or yellowish, devoid of taste or smell. It is demulcent, and is used in coughs and catarrhs, and to make lozenges and pills. It is employed also in calico-printing and the thickening of milk.

Tragedy, a play or other literary work of a serious or sorrowful character, with a fatal or disastrous conclusion; often used as the antonym to comedy. The word is derived from the Greek τραγῳδία, a goat-song, so called either because a goat was the prize in early days, or because the actors were clad in goat-skins. (See article *Drama*, and such articles as *Æschylus*, *Sophocles*, *Euripides*, *Seneca*, *Marlowe*, *Shakespeare*, *Webster*, *Corneille*, *Racine*, &c.) Greek tragedy arose from the dithyrambs or songs composed in honour of Dionysus. Its scope was extended in one direction or another by each of the three great tragedians whose work has been preserved. Aristotle's theory of tragedy is expounded with great clarity in his *Poetics*. According to him, "Tragedy is an imitation of an action that is serious, complete, and of a certain magnitude; in language embellished with each kind of artistic ornament, the several kinds being found in separate parts of the play; in the form of action, not of narrative; through pity and fear effecting the proper purgation of these emotions". There are six elements in tragedy: three external, spectacular presentment, lyrical song, and diction; and three internal, plot, character, and thought. Plot, the representation of the action, is of primary importance. The plot must be a whole, and complete in itself. Pity is aroused by unmerited misfortune, fear by the misfortune of a man like ourselves; therefore a tragic hero should be neither entirely virtuous nor an utter villain, but a man who is not eminently good and just, yet whose misfortune is brought about not by vice or depravity, but by some error or frailty. Aristotle put forward many suggestive speculations in his treatise; he did not intend to legislate for tragic poets for all time. Unfortunately many critics after the revival of learning treated the *Poetics* as a Draconian code from which there was no appeal. The notorious 'unities' fettered tragedy until finally shattered by Coleridge, who pointed out that all rules are simply means to an end. If the ends are different, naturally the means are too. The Greek chorus could be brought to a place, but a place could not be brought to them without as palpable an equivoque as bringing Birnam Wood to Dunsinane; hence the need for unity of place is not felt when there is no chorus. If the law of actual perception is once violated—as it is in Greek tragedies—why is it more difficult to imagine three hours to be three years than to be a whole day and a half? Hence there is no need for unity of time. Coleridge went on to point out that Shakespeare only failed to conform with the *accidental* rules of the Greek drama. In spirit he is far nearer to Aristotle's rules than Corneille or Racine, though in letter he is far from any rules.

Elizabethan tragedy, properly so called, arose out of chronicle-history plays. Unity was secured in them by means of a central figure, and emphasis was laid on character. There was tragic situation but no tragedy before Marlowe. Anything mournful, cruel, or bloody is tragic, but not tragedy. Tragedy is a sequence of incidents or episodes, so presented as to emphasize with seriousness their causal relationship. Chance is predominant in comedy; in tragedy it plays a very minor part. Melodrama is inadequately motivated emotion, which stops at nothing to gain its effect. As far as material goes, the great tragedies of Shakespeare might be classed with chronicle-plays. It is the *treatment* which distinguishes them. To the Elizabethans the tragedies seemed merely more masterly specimens of dramatic story-telling than the plays which had gone before; more masterly because they told in absorbing fashion stories involving the most intense and subtle emotions. Shakespeare had no theory of tragedy, so we cannot find one in him. *Macbeth* in a sense is Greek, i.e. it can be regarded as a fulfilling, struggle though the victim may, of a blind fate; *Hamlet* is a struggle between a man's temperament and his environment. In *Othello* there would have been no tragedy without Iago; in *King Lear* none without Goneril and Regan; so both of these tragedies are struggles of temperaments. Shakespeare discovered all the sources of tragedy, instead of assuming that it came from one source. Each new play with him was a fresh problem to be separately solved, though, of course, every conquest made his judgment surer. He invented no formula.—BIBLIOGRAPHY: A. H. Thorndike, *Tragedy*; W. L. Courtney, *The Idea of Tragedy*; S. H. Butcher, *Aristotle's Theory of Poetry and Fine Art*; S. T. Coleridge, *Notes and Lectures on Shakespeare*; A. C. Bradley, *Shakespearean Tragedy*; G. P. Baker, *The Development of Shakespeare as a Dramatist*.

Trag'opan, a name of certain beautiful birds of the genus Ceriornis, and of the family Phasianidæ, closely allied to the common fowl. *C. saty̆rus*, the horned pheasant, is a native of the Central and Eastern Himálaya. The plumage is spotted, and two fleshy protuberances hang from behind the eyes. When the bird is excited, it can erect these protuberances until they look like a pair of horns. *C. melanocephalus* is found in the Western Himálaya, *C. temminckii* and *C. caboti* in China, and *C. blythi* in North-East Assam.

Train-bands, a force partaking of the nature of both militia and volunteers, instituted by James I and dissolved by Charles II. The term was afterwards applied to the London Militia, from which the 3rd regiment of the line originated, and in which Cowper's John Gilpin was a captain.

Train Ferry. The transit of goods from their place of manufacture to the docks by rail, followed by unloading and shipment by sea to the country of usage, where the same processes are reversed, is the source of considerable waste. The time taken in unloading the wagons, and restowage in the ships' holds may be eliminated by the use of train ferries. In the period of the European War, munitions were sent from Britain to France on this system. It consists simply in the use of ferry boats on the decks of which there are lengths of railway lines whereon the wagons are retained during the voyage. The locomotives deliver the wagons on to the ferries, and effective chain moorings prevent their moving during the voyage across the Channel. At the other end of the journey a locomotive draws off the wagons and takes them to their destination. With the train-ferry system in use there is but one loading and one unloading as compared with three loadings and three unloadings in the ordinary system of transferring goods from an inland town in England to one in France, Holland, or Belgium. There are some points in the design of the shore equipment which must not be overlooked. The fixed-level railway must be put into communication with the rails on the ship, whose height position is determined by the state of the tide and the load on the vessel. It is obvious that the outer part of the jetties must be made in the form of movable bridges and provided with some type of lifting equipment. Powerful train ferries are used by the Danish railways and on Lake Baikal. Trains of the Trans-Siberian Railway are conveyed by ice-breakers from Listvinichnoe to Mysovsk.

Trajan, in full, Marcus Ulpius Trajanus, Roman emperor, born in Spain A.D. 53, died in 117. The son of Trajanus, a distinguished Roman commander under Vespasian, he served against the Parthians and on the Rhine, where he acquired so high a character that Nerva adopted him and created him Cæsar in 97. Nerva died in 98, and Trajan, who was then in Germany, peaceably succeeded to the throne. He made peace with the German tribes, and proceeded to introduce enlightened measures of reform into the public service. One of his greatest military achievements was his defeat of the Dacians, and the reduction of Dacia to a Roman province (see *Roumania*). It is supposed that it was in commemoration of this war that he erected at Rome the column which still remains under his name. In 103 he wrote the famous letter to Pliny (q.v.), Governor of Pontus and Bithynia, directing him not to search for Christians, but to punish them if brought before him; and on no account to listen to anonymous charges. For some years Trajan occupied himself with the work of administration, but in 114 he set out on an expedition against the Parthians which resulted in the reduction of Armenia to a Roman province. He died at Selinus, in Cilicia, after having nominated Hadrian as his successor. He is said to have been sensual in his private life, but his good qualities as a ruler were such that even 250 years after his death senators greeted a new emperor with the wish that he might be more fortunate than Augustus and better than Trajan.

Trajan's Wall, an ancient Roman fortified line of Bessarabia, Roumania, built between A.D. 105 and 155, extending from the Pruth eastwards to Lake Sasik or Kunduk. Another triple fosse extends from the Danube to Constanţa, the greatest of which is ascribed to Trajan.

Tralee', a seaport-town of Kerry, Ireland, the county town, on the Lee; connected by canal with Tralee Bay. It has an active shipping trade in farm produce. Pop. 10,300.

Trammel, an instrument for drawing ellipses, used by joiners and other artificers. One part consists of a cross with two grooves at right angles; the other is a beam-compass carrying two pins which slide in those grooves, and also the describing pencil. The semi-axes of the ellipse described are the distances of the tracing-point from the pins.

Tramways. The introduction of tramway traction marked a great development in convenient and comfortable travelling facilities within the large urban and suburban areas of our own and other countries. It is claimed for Birkenhead that the tramway system started there in 1860 was the first system in operation in Great Britain. Since that date many changes have been introduced into the systems of working, and much progress has been made. While tramway traction has at present, and had to a greater extent in the past when there was no satisfactory alternative, many advantages, the troubles caused through traction on fixed rails in large cities must not be lost sight of. In most of our towns the tramways are owned by the municipalities, and in too many cases have been developed and run without any consideration of traffic congestion, the rights of other users of the roads, and the costs of remaking the roads near those where the tramways operate, because of the deflection of heavy traffic from the main arteries to streets that were never constructed to deal with such loads. In almost every large provincial city in Britain to-day there is a traffic congestion problem, due in some cases almost entirely to the use of tramways, and in every other, largely contributed to by the same agency. The introduction of double tracks in comparatively narrow roads should be avoided, and in fact only used when the road is wide enough to permit the passage of two lines of ordinary traffic in the space between the tramway zone and the kerbstone. Double-track crossings at busy centres in the heart of a city should be avoided. With these limitations the advantages of tramway traction may be obtained without the expensive congestions that are quite common. It is doubtful, however, whether the use of motor-buses would not afford a better solution of the problem of transporting the people between their homes and their business places. In some cases the advantage would undoubtedly rest with the motor-bus, but there are others where the position is not quite so clear.

The proposals for a tramway scheme must be submitted in a Bill to Parliament. Powers are only granted after the system proposed and the manner of its application have been submitted to discussion and the possible opposition of the interests affected. By-laws regarding equipment have been framed, and all the construction is subject to the inspection of the Board of Trade before the system is approved for working.

Almost every type of propulsion scheme has been applied to the operation of tramways: steam traction engines, gas and petrol engines, and electric motors. Except in a few isolated cases the electric system has prevailed, and the common arrangement is to convey the power through an overhead conductor and use the tram rails as the return, but there are also some installations in which the cable is housed in a conduit below the surface of the road. The equipment in use has become practically standardized the world over. The electricity supply is usually at 500 volts, but pressures as high as 750 have been put into service. Wheeled trolleys or bow collectors convey the electricity from the overhead wire to the controller, through which it can be passed to the power units. Drum controllers are the common type, and they are wired to permit of the connection of the motors in series or in parallel, with resistances at first, but later cut out in sections. Two motors of 30 to 40 h.p. having series winding, with four poles and sometimes interpoles, constitute the usual equipment. Effective braking is essential, and is commonly worked by air or by the conversion of the electric motors into generators to energize magnetic rail brakes, but hand brakes are fitted as spares.

The trolley lines are divided up into sections separated by insulators and fed from cables connected with the central or sub-station through section switches in pillars beside the line. The wire is supported on spare wires, side brackets, or centre poles. Guard wires are run above the trolley wires to afford protection from contact with falling wires or trees. As limits have been placed by the Board of Trade on the maximum drop in pressure in tramway rails, it is common to provide copper bands at the rail junctions, the rails being frequently welded together at these points. As earth leaks may cause corrosion of pipes in the ground, their magnitude is limited by regulation. The corrosion is caused by the current entering and later leaving the buried pipes in its travel back to the supply station.

The conduit system costs much more for its installation than the overhead system, the disparity varying according to the locality and the conditions, but cases have been noted where the conduit scheme cost 80 per cent more than the common overhead equipment. The slot of the conduit usually occupies the mid position between the rails, but there are examples on the Continent where the slot is at the side and serves as the groove in the ordinary tram rail. The conductors are mounted on insulators in the conduit, and the connection is made to them by cast-iron shoes pressed to the conductors by semi-elliptical springs. A combined use of conduit and trolley-wire systems has been made in some few cases, but not always with success.

Trance, a condition resembling sleep, in which consciousness and many of the vital functions are suspended, and during which the action of the heart is diminished and the breathing reduced. The subjects of trance are usually hysterical, and in some cases the condition is induced by exhausting disease or emotional disturbance. During a trance the face is pale, the limbs relaxed, the mental functions are in abeyance, and no effort at rousing will produce a return to consciousness. This state may last from a period of several hours to many weeks or months. When the trance lasts for a lengthy period, food is taken in a mechanical way at intervals by the sleeper. Most cases recover. The term is also applied to a sort of ecstatic state into which some persons are said to fall, and in which, while unconscious of what is passing around them, they have remarkable dreams or visions.

Trani (ancient **Turenum**), a coast town of Apulia, South Italy, in the province of Bari, on the Adriatic; served by the Ancona-Brindisi Railway. An important seaport-town in the period of the Crusades, its harbour is now entirely silted up. Pop. 32,060.

Tranquebar′, a seaport in the district of Tanjore, Madras Presidency, India. It was made a Danish settlement in 1616, and sold to the British in 1845. The town was the first settlement of Protestant missionaries in India. Pop. 13,000.

Transbai′kalia, a province of the Far Eastern Republic; served by the Trans-Siberian Railway; area, 238,308 sq. miles. It has an elevated, well-watered surface, and climate dry and extreme both in summer and winter. Agriculture and trade limited; gold found to some extent. Pop. about 946,000.

Transcaspia, a Russian Asiatic province extending along the eastern shore of the Caspian Sea; traversed in the south by the Transcaspian Railway from Krasnovodsk. It is largely a desert region, but in the south, wheat and other cereals, and live-stock are raised, and lignite, salt, &c., are worked. Area, 230,000 sq. miles; pop. 500,000.

Transcaucasia, a former Russian lieutenancy south of the Caucasus (and therefore in Asia Minor), which comprised the governments of Black Sea, Kutais, Tiflis, Baku, Erivan; the provinces of Elisavetopol, Batoum, Kars; and the districts of Zakatali and Sukhum; total area, 95,400 sq. miles. It is now divided among the Republics of Armenia, Azerbaijan, and Georgia. The chief rivers of the region are the Rion and Kura; the mountains are treated under *Caucasus*. Ethnologically considered, the chief people are the Russians, Georgians, Armenians, and Tatars, but the general population forms an extraordinary olla-podrida of nationalities. The population (pre-Revolutionary) was 7,500,000. Towns of importance include: Tiflis, Baku, Novorossiysk, Elisavetopol, Erivan, Kutais, and Batoum. See articles on *Poti* and governments, rivers, towns, &c.

All the Transcaucasia Republics were federated on 10th Dec., 1922, and this union formed a prelude to the general federation of Soviet Republics, which was accomplished on 30th Dec., 1922, the new organization being styled 'Federation of Soviet Socialist Republics', or F.S.S.R. for short. Moscow was the capital of the federation, and White Russia, Transcaucasia, Ukraine, and Soviet Russia the component states. The Congress was the chief legislative body, but generally chief power lay in the hands of the Federative Central Executive Committee of 371 members, of which Russia had 170, Ukraine 68, Transcaucasia 26, and White Russia 7.

Transcendent and **Transcendental**, philosophical terms employed by the Scholastics and applied to notions wider than the Aristotelian categories, as being, goodness, or unity. Kant applied the term *transcendental* to all those principles of knowledge which are original and primary, and which are determined a priori, such as space, time, and causality. Although not products of experience, they are manifested in experience, but go beyond empiricism, i.e. transcend it. By *transcendent* Kant understood all that lies *beyond* the limits of experience, and is thus inaccessible to it.

Transcendentalism, the term applied to the philosophy of Kant and to any other systems which, without exactly considering experience as untrustworthy, dwell in the regions beyond experience, and maintain that there is a knowledge of transcendental elements, or a priori conditions of experience. The term transcendentalism is also applied to the New England movement originated by Ripley, Emerson, and others, whose ideas transcended reason, and who laid stress on the intuitive and the mystic. They were influenced by German idealism and French sociological doctrines, and were opposed to conventionalism and formalism. Economically, they were inclined to socialism, and made an experiment in the famous Brook Farm (q.v.).—Cf. H. C. Goddard, *Studies in New England Transcendentalism.*

Transept (Lat. *trans*, across; *septum*, enclosure), in architecture, the transverse portion of a church which is built in the form of a cross; that part between the nave and choir which projects externally on each side, and forms the short arm of the cross in the general plan. See *Cathedral.*

Transformer, any type of electric plant by which the pressure may be changed. The common usage is to apply the term to those stationary units installed to change the pressure of alternating-current supply, but it might reasonably be extended to cover the transformations effected by rotary converters in producing direct currents from alternating currents or to rectifiers by means of which unidirectional currents may be obtained from the same source.

A simple single-phase transformer has two distinct coils, known as the primary and the secondary, wound upon an iron core built up of wire or thin sheets in order that eddy currents within it may be kept down to a minimum. The factor which fixes the magnitude of the change of pressure is the ratio of the number of turns on the two coils. Similar alternating currents to those in the primary winding are induced in the secondary circuit, at a different pressure. If the circuit supplies polyphase currents, similar ones may be produced at lower or higher pressure by transformation, the separate phases being dealt with in coils each on its own core.

The possibility of effecting pressure transformation of alternating currents by stationary plant is of great economic advantage, and it is for that reason that electricity is generated at high pressure for transmission, with resulting small losses, and transformed to low pressures for delivery to consumers. The common arrangement is to produce three-phase currents at high potential—6500 volts is a common value—and to send that supply out to sub-stations scattered over the district. When the consumer receives an alternating-current supply, the pressure may be fixed to suit the conditions of the work to be done, but generally three-phase supply at 440 volts is the standard. If direct current is necessary, it can only be obtained by the use of rotating plant of the rotary converter or motor generator type. In the plant first mentioned both the alternating-current input and the direct-current output are dealt with by the same rotor, but separate machines directly coupled comprise the second system.

Most high-pressure transformers are immersed in oil in a tank usually built up of steel plate welded into the form desired. The heat from the coils is taken up by the oil and radiated from the ribbed surface of the tank. Water cooling for the oil may be used to assist the process. The oil used for the purpose must be free from even traces of water, otherwise the insulation resistance of the coils will be greatly reduced. In addition to their use for changing the pressure of a supply system, transformers are used for many other purposes. For starting alternating-current motors, a single-coil device known as an auto-transformer is sometimes used. They are connected across the full pressure of the supply, and tappings may be taken from various points on the coil to obtain different pressures. Another use is for the instruments in alternating-current power supply stations. Step-down transformers giving low pressures are in common use for that purpose.

Rotary converters have some advantages over the complex separate machines known as motor generators, in cost, compactness, efficiency, and commutation. An induction motor is commonly installed on the rotary converter shaft to bring it up to speed. Starting from the alternating-current supply or from the direct-current side of the system is possible with a motor generator.

Rectification of an alternating current is possible by the use of a commutator driven at the speed of synchronism. Another method is to use an alternating-current electromagnet to oscillate an armature which is suitably pivoted and gives reversal of the connections with the reversal of the current. When an aluminium electrode is placed in a concentrated solution of neutral ammonium phosphate, carbonate, or oxalate, current will flow through it to any other electrode in one direction only. The action depends upon the effect of a film of aluminium hydroxide. Ionized mercury vapour has the property of conducting electricity in one direction only, and is used for rectifiers of small power. See section on *Thermionic Valve* in article *Wireless Telegraphy*; *Induction Coil.*

Transfusion, the transmission of blood from the veins of one living animal to those of another, or from those of a man or one of the lower animals into a man, with the view of restoring the vigour of exhausted subjects. This operation is a very old one, but seems to have generally ended in failure until about 1824. Recent researches have shown that the blood of human beings differs in different individuals, there being several *groups* of both blood corpuscles and sera. These *groups* are not all compatible with each other. Hence a suitable *donor* must be identified before proceeding to transfusion. *Infusion* of suitable bland solutions is also commonly practised. Remarkable results were achieved by both methods during the European War.

Transit, in astronomy, (*a*) the passage of a heavenly body across the meridian of any place, a phenomenon which is usually noted by a transit instrument. The determination of the exact times of the transits of the heavenly bodies across the meridian of the place of observation enables the astronomer to ascertain the differences of right ascensions, and the relative situations of the fixed stars, and the motions of the sun and planets parallel to the celestial equator. (*b*) The passage of one heavenly body between a larger heavenly body and the observer's position, so that it appears to traverse the disc of the latter body. The term is chiefly used of transits of Mercury and Venus across the sun's disc, or of Jupiter's satellites across that of their primary. Transits of Venus are of rare occurrence, four taking place in 243 years, at intervals of 8, 122, 8, and 105 years. On account of the position of the nodes of the orbit, they can occur only on or near the dates 5th June and 7th December. A pair of December transits occurred in 1631 and 1639, and another in 1874 and 1882. The last June transits were in 1761 and 1769; the next will be in 2004 and 2012. The longest duration of a transit of Venus is about eight hours.

The path across the sun as seen from different terrestrial view-points is different, and a method based on the comparison of such observations was formerly the most accurate means of measuring the sun's distance, and was that by which a tolerably correct determination was first obtained. The results in 1874 and 1882 did not come up to expectation, and it became evident that this method is much inferior to others which are now available. The drawback lies in the difficulty of noting the exact instants of the planet's ingress and egress upon the sun, on account of an encircling luminous ring due to its atmosphere, and also on account of the optical phenomenon of the 'black drop', a ligament which seems to connect the planet with the sun's limb for a moment at each internal contact. Venus when in transit can be observed by the eye, through darkened glass; transits of Mercury, which occur much more frequently, can be seen only with telescopic aid.

Transit Circle, or Meridian Circle, an important astronomical instrument adapted for observing the exact time of the passage of heavenly bodies across the meridian, and the altitude at which they cross it. A horizontal axis is supported upon pivots carried by two fixed piers which have deep foundations and are out of connection with the surrounding floor. The horizontal axis is in an east and west direction, and as the telescope tube is at right angles to it, the telescope turns in the plane of the meridian. A frame carrying 'wires' of spider thread is placed in the focal plane, and the observer notes the time at which the image of the star or other object is seen to cross each wire. The average of these times, properly reduced, gives the time on the clock at which the object crossed the meridian. There is attached to the horizontal axis a large and accurately graduated circle, which turns with it. By means of this circle, the graduations of which are viewed through fixed reading microscopes, the exact position in which the telescope is pointing, and thence the meridian altitude of the body observed, can be determined. If the instrument is designed only for observing times of transits, and not altitude, it is called a *transit instrument* (q.v.).

Transit Instrument. This is an instrument of the same principle of construction as the transit circle (q.v.), except that it is not provided with the large graduated circle and reading microscopes for obtaining the exact altitude of an object observed. Its use is therefore confined to observing the instant of an object's transit across the meridian, but with that exception the account of the transit circle may be taken as applying to the transit instrument, and the following remarks are supplementary and relate to both instruments. Theoretically, the optical axis of the telescope should revolve exactly in the plane of the meridian, passing through the nadir, the north point of the horizon, the pole of the heavens, the zenith, and the south point of the horizon. However nicely the adjustments are made, this can never be exactly attained, and therefore in practice the errors are first reduced to very small amounts, and then are accurately determined, and allowances made for their effects on the results of observations. There are three kinds of error: (1) error of inclination, or level, one of the pivots for supporting the telescope axis being higher than the other; (2) error of azimuth, one of the pivots being slightly farther south than the other; (3) error of collimation, the optical axis of the telescope not being precisely at right angles to the axis of revolution. These errors of the instrument must be frequently ascertained; where great accuracy is necessary, they must be ascertained afresh on every occasion of an observation. The several errors are found by various methods: by the use of collimators (q.v.), by a striding level, by observing the coincidence or amount of separation of the wires and their images as reflected through the telescope from a trough of mercury below the instrument, and by observations of the Pole Star. The telescope can be reversed in its bearings so that the (formerly) west end of the axis rests upon the eastern pivot. This is useful in the process of determining the errors. Also if two stars are observed for time, the instrument being so reversed between the observations, inaccuracy due to imperfect allowance for the instrumental errors can to a large extent be eliminated in the mean result.

The following expresses in brief the result of an observation for time actually taken at an observatory on 23rd Aug., 1922. The star observed was α Herculis.

	Hr.	Min.	Sec.
Observed time[1] of transit by sidereal clock	17	9	56·46
Correction[2] for collimation error ..			+0·11
„ inclination „ ..			+0·20
„ azimuth „ ..			+0·05
Corrected time of transit by sidereal clock	17	9	56·82
Star's right ascension	17	11	7·65
Error of clock		1	10·83 slow.

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[1] Recorded by chronograph (q.v.), the transit being observed over thirteen wires.

[2] These corrections are computed for the particular star, as they vary with the declination.

As a rule the sidereal clock is readjusted only at very long intervals, but careful attention is always paid to its error and rate. By an intercomparison of the sidereal and mean time clocks, the mean time clock error is then found, and any necessary adjustment can be made. In this instance the error of the mean time clock was found to be 0·11 of a second different from what it had been estimated to be immediately prior to the observation, judging from the error of the standard sidereal clock as determined by stellar observation a few days previously and its assumed rate in the interim.

Transjordania or Kerak, an independent emirate of Arabia, extending eastwards from the Jordan into the Syrian desert, and lying between the River Yarmuk (a large perennial affluent of the Jordan) on the north and the Hejaz in the south (see coloured map under *Palestine*). Transjordania is a high dissected plateau which is divided into: (1) the Jebal Ajlun, lying between the Yarmuk and the Wadi Hesban; (2) the mountains of Moab, between the Hesban and the Wadi al-Hasa; and (3) the southern plateau. The Jordan, the Ghor, and the Dead Sea are dealt with under *Jordan*, *Palestine*, &c. Traversing the country from north-west to south-east is the great depression, the Wadi Sirhan, which forms a convenient highway from Hauran to Jauf. The Syrian section of the Hejaz Railway (to Medina) runs through the country from north to south. Amman (pop. 2500) is the capital, but Es-Salt, a great agricultural and wine-growing centre, noted for its sultanas, and said to stand in a phosphate- and petroleum-yielding district, is the most populous town (8–9000). Others are: Al-Kerak (2500), which withstood a five years' siege during the Crusades, and was finally taken by Saladin in 1188; Ma'an (3000), a centre on the old pilgrimage route to Mecca, but now on the Hejaz Railway; Hesban; and Madeba (7000). Although nominally under the British mandate for Palestine, Transjordanian independence is a real thing, and the government is more or less secure.

Transjordania has a great Biblical interest. Amman is *Rabbah* (*Rabbath-benē-Ammon*) of the Old Testament. It was the chief Ammonite city, and the only one mentioned in the Bible. Under the Ptolemies it was called *Philadelphia*, in honour of Ptolemy II (Philadelphus). Es-Salt is said to represent *Ramoth Gilead*; Kerak represents *Kir* (or *Ar*) of *Moab*; Madeba is the scriptural *Medeba*; and Hesban represents the Moabitic city of *Heshbon*.

Transkei, an eastern district of Cape Province, Union of South Africa, forming part of Kaffraria.

Transmigration of Souls, the doctrine which teaches that after the death of the body the soul passes through the bodies of the lower animals or other human bodies, or even through plants and inanimate objects. The belief in the transmigration of souls, which results from the doctrine of totemism and from the belief that after death man rejoined his totem, is not only common in primitive animistic religions, but forms also a part of certain advanced religious systems, where it is connected with the ideas of immortality and of retribution. In the teaching of the Brahmanic Hindus the doctrine has its foundation in the belief of the connection of all living beings, and of the gradual purification of the spiritual part of man and its return to the common source and origin of all things—God. It is the means by which *Karma*, or the law of moral retribution through a series of rebirths, takes place. The doctrine formed part of the secret teaching of the Egyptian priests, and it was from Egypt that it passed into Greece. Pythagoras, who is supposed to have remembered his experiences in his previous states, was the first to teach the doctrine in his system, although Thales and Pherecydes are both said to have preceded him in teaching it. Plato, in his *Phædo* and in the *Republic*, supports the doctrine, and it forms part of the philosophical system of Neo-Platonism. The belief in metempsychosis is also found in the *Talmud*, where it is connected with the idea of penance and retribution, and has been held by various heretical Christian sects, such as the Valentinians and the Manichæans. It was professed by the Arabs before Mahomet, but was not admitted by him into the *Koran*. The doctrine appears in the Jewish Cabbala, and in modern times it has been to a certain extent advocated by Lessing and has been taken up by theosophy (q.v.).—BIBLIOGRAPHY: F. B. Jevons, *Introduction to the History of Religion*; A. Bertholet, *Transmigration of Souls*.

Transport, or the business of carrying a person or thing from one place to another, is as old as the human race. Animals were early employed as beasts of burden and to draw wheeled vehicles. Probably the invention of the boat followed. After these early beginnings, the means of transport by land remained more or less the same for a long time, but transport by water was improved by the introduction of sails. At last, in 1825, George Stephenson applied the steam-engine to land transport on the Stockton-Darlington line. As early as 1812 the steam-engine was applied on the Clyde to marine transport. The developments in steam practice were continuous and fairly rapid until about 1880, when the possibilities of electric traction began to receive serious attention. The earliest electric railway was the City and

South London Railway, which was opened about the year 1890. Since that year invention has followed invention. The electric railway has been perfected and the internal-combustion engine has been developed. The latter invention gave us the motor-car, the aeroplane, and the airship; while the electrical storage battery and the electric motor have solved the problem of transport beneath the surface of the sea. The following is a summary of the present position of the more important means of transport.

1. *Transport by Rail.*—The most powerful British passenger locomotives can haul trains of 500 to 600 tons at speeds of 50 to 60 miles per hour. The best passenger services in this country run long journeys at an average speed of nearly 50 miles per hour. For example, the midday West Coast Express from Glasgow to London leaves Glasgow at 1.30 p.m., and reaches Euston at 10 p.m., the journey being 401 miles. The average speed is thus 47·2 miles per hour. The train usually consists of ten coaches weighing about 340 tons in all. Before the European War, this run was made in 8 hours at an average speed of 50 miles per hour. On the Continent, and in the United States, passenger locomotives are found that greatly exceed in power anything known or required in this country. For instance, the 4—6—2 tender type of engine for passenger service is common abroad, but it is only found in two instances in Great Britain, and in these, not in its most highly developed form. Train loads are commonly heavier in Europe and much heavier in America, and the average gradient on the tracks much more severe. Fuel is also, as a rule, poorer. Larger engines are therefore essential and their use is possible on foreign railways, because these railways have the advantage of larger loading gauges, both lateral and vertical. The heaviest British passenger locomotives used to-day are as large as the existing loading gauges permit, so that any further increase in size of the locomotive—except in length—would involve track alterations of a costly nature. As a typical example of Continental practice, the four-cylinder compound superheater 4—6—2 engines of the Paris-Lyon-Méditerranée Railway may be cited. One of these locomotives, on test, hauled a passenger train of 646 metric tons (exclusive of engine and tender)—equivalent to 635 British tons—over a difficult line at an average speed exceeding 50 miles per hour, developing an indicated horsepower of 2425 as a maximum. The locomotive was not ' forced ' on this test, and it is probable that many Continental locomotives are capable of a similar performance. In the United States, much larger and more powerful passenger locomotives are in common use. They are less costly to construct than European models, but are usually less efficient. As examples of typical United States express passenger services, the *Twentieth Century* and the *Broadway Limited* may be mentioned. These trains run between Chicago and New York. The former is run by the New York Central Railway, the distance being about 980 miles; the latter by the Pennsylvania Railroad, about 946 miles. The train-weights often reach as much as 1200 tons (with two engines)—nearly double the maximum weights run on British lines. Before the European War, the trains made the run in 18 hours, but one winter there were several accidents, and by common agreement the running time was changed to 20 hours. The average speed thus reaches 49 miles per hour on the 20-hour schedule, and 54½ miles on the 18-hour schedule. Allowing for stops, these figures mean that the actual running speeds would probably touch 70 miles per hour at times. Remembering that the trains may weigh some 1200 tons, this performance is remarkable, even though two locomotives are used.

In *goods transport*, the largest British goods steam locomotives regularly haul trains of 1200–1500 tons at a schedule speed of 25 miles per hour. The Great Northern Railway (L. & N.-E.) runs a regular service of goods trains, weighing about 1800 tons, between Peterborough and London, at a speed of 20–25 miles per hour. This is the order of things on the Continent as well. In America, where larger locomotives are possible because of the larger loading gauge, goods trains about 5000 tons are handled regularly, but speeds are very low—12 miles per hour for the heavier trains, and even less for the heaviest ones. American and British policy in freight-haulage is exactly opposed, the one country preferring very heavy trains at low speeds; the other, relatively light trains at high speeds. On the North-Eastern Railway (L. & N.-E.), mineral goods trains of 1500 tons are now being handled at speeds of 25 miles per hour by electric locomotives.

2. *Transport by Road.*—Heavy road transport is now carried on by motor-cars and motor-lorries. The touring motor-car has been built in sizes up to about 70 b.h.p., and can attain very high speeds. Speeds as high as 140 miles per hour have been obtained at Brooklands in competitive motor-car races. The motor-lorry is petrol- or steam-driven. The usual petrol lorry carries about 3 tons; the steam-driven one about 6 tons. The cost of a 3-ton petrol motor-lorry is (1923) about £700, and the cost of running, including the cost of repairs and upkeep, ranges from about 12 pence per mile for a ' 250 mile week ' to 10 pence for a ' 350 mile week '.

3. *Transport by Sea.*—Sea-transport reaches its highest point of development in the North

Atlantic trade. In luxury of accommodation, comfort of travel, amusements, business facilities, and in speed the famous liners in the North Atlantic trade leave little to be desired. These liners occupy much the same position, to-day, as the famous tea-clippers, such as the *Cutty Sark*, did half a century ago. In the article *Shipping*, details are given of speed, type of power, and tonnage, for the world's twelve largest ships. The annexed table contains further particulars of some of these.

Steamer.	Length.	Beam.	Draught.		Horse Power.	Carrying Pass.	Capacity Cargo.
	Feet.	Feet.	Ft.	In.			Tons.
Majestic ex Bismarck	954·5	100	38	11½	66,000	900 1st 725 2nd 2438 3rd	954
Aquitania	902	96·5	36	2	56,000	757 1st 635 2nd 1300 3rd	2393
Olympic	882·7	92·5	84	7	55,000	947 1st 496 2nd 1254 3rd	2091
Mauretania	787	87·5	36	2½	68,000	589 1st 399 2nd 767 3rd	1092
Homeric	776·75	83·5	35	3½	28,000	443 1st 510 2nd 1758 3rd	7597

4. *Transport by Air.*—The claims of the aeroplane and the airship as agencies of commercial transport were vindicated in 1919, when the Atlantic was crossed successfully by both types of aircraft. Regular Continental air services have run since 1919. The first actual crossing of the Atlantic was made in the early months of 1919 by an American, Lieutenant-Commander Read. He came from America to England via the Azores and Lisbon. This flight included a remarkable passage of 150 miles under power on a rough sea in the flying-boat N.C. 4. On 14th and 15th June of the same year, Alcock crossed the Atlantic on a Vickers-Vimy aeroplane with twin Rolls engines, in 16 hours 12 minutes, non-stop. Hawker had attempted the flight on a Sopwith machine previously, but was forced to descend in mid-Atlantic. He was, however, rescued. In the late autumn of the same year Ross-Smith and his brother flew another Vickers-Vimy machine to Australia in 28 days.

The R 34 is the only airship which has flown across the Atlantic and back. It accomplished the whole round trip in under eleven days. She left East Fortune Aerodrome, in Haddington, under the command of Commander G. H. Scott, C.B.E., A.F.C., at 1.48 a.m., Greenwich time, on the 2nd July, 1919, and landed at Mineola, Long Island, New York, at 2 p.m., Greenwich time, on the 6th of July. The time taken was thus 108 hours for a total distance of 3600 British statute miles, giving an average speed of 33½ miles per hour. The weather encountered was very unfavourable, a heavy storm being met with shortly after leaving the Irish coast, and a severe thunderstorm over New Brunswick. After refilling and provisioning, the return journey was commenced at 3.45 a.m., Greenwich time, on 10th July, and finished at Pulham, Norfolk, at 6.57 a.m. on the 13th of July. The distance covered on the return journey was 3450 statute miles, and the average speed 46 miles per hour.

The following are some particulars of the Handley-Page Continental service and the aeroplanes engaged in it. The services were inaugurated on the 2nd Sept., 1919, and, with the exception of one fortnight, have been running continually ever since. This service is to Paris. The present machines used are the Handley-Page W.8 B. type. This machine is fitted with two Rolls-Royce 'Eagle VIII' engines of 350 h.p. each, and they develop a speed of over 100 miles per hour. The normal cruising speed is 90 miles per hour. Luxurious accommodation is provided. The aeroplane has a closed cabin, in which there are twelve cushioned arm-chairs for passengers. The cabin is large enough to allow passengers to move about in it freely. Large side windows—one for each passenger—are also provided. A small perfectly-equipped toilet room adjoins the saloon. Newspapers and periodicals are provided and instruments to show the height and speed of the machine. The luggage is carried in a separate compartment at the forward end of the aeroplane. Every machine is fitted with wireless telephones. Each aeroplane takes 12 passengers, 2 pilots, a wireless operator, and 1200 lb. of passengers' luggage. Taking each person at 150 lb. this means that the load carried is about 1½ tons. As a matter of fact, a machine of this type, fitted with two Napier 'Lion' engines of 450 h.p. each, holds the world's record for commercial weight lifting. It succeeded in lifting just on 1¾ tons of commercial load, and ascending with it to an altitude of over 2½ miles. The present fare from London to Paris is 6 guineas single, and £12 return. The journey takes about 3½ hours each way. See articles *Tramways*; *Steam-engines*; *Internal-combustion Engines*; *Locomotive*; *Roads and Pavements*; *Shipbuilding*; *Shipping*.

Transport, Ministry of, administrative department of Government established by the Ministry of Transport Act, 1919, for the purpose of improving the means of locomotion and transport in the United Kingdom. All the functions of other Government departments in relation to railways, tramways, canals, roads and bridges, harbours, docks, &c., were concentrated in the hands of the new ministry. Power was given to establish and work transport services by land or water. The ministry was responsible for the scheme of railway reorganization which came into operation in 1921. Separate departments deal with development, traffic, roads, finance, &c. The work of the ministry has been severely criticized, and the Geddes Economy Committee in 1922 recommended its absorption by the Board of Trade. An alternative proposal receiving the consideration of the Government is its amalgamation with the Post Office and the formation thereby of a new Ministry of Communications. The Minister of Transport now acts without salary.

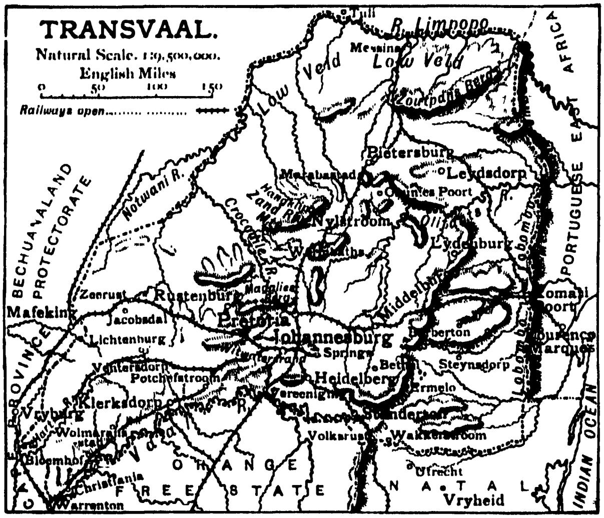
Transport and Supply, Military. The tribesman of the North-West Frontier of India or the negro of the African forests, living under much the same conditions as have held good for hundreds of years, can still exist on a handful of parched grain or a few sweet potatoes or *yams*, and the conditions of his life make it possible for him not only to exist but to do hard work on very scanty fare, which he can carry for himself. He is, in fact, his own supply and transport. Modern armies, on the other hand, are composed of men who are accustomed to live a gregarious life in town or country, and who, from their upbringing, would be practically helpless if left to themselves; moreover, the organization and size of an army, and the requirements of discipline (without which an army would be merely an armed rabble), make individual or promiscuous foraging an impossibility. The oft-quoted dictum that "an army, like a serpent, goes on its belly" attributed to Frederick the Great of Prussia, or that of the great Duke of Marlborough, who is said to have expressed the same axiom in the words "No soldier can fight unless he is properly fed on beef and beer", is as true now as when it was made, and the complexities of 'supply' and 'transport' are far greater now than they were in the eighteenth century. The comparatively small armies of those days could and did live largely on the country in which they were operating; at the present time, the far greater proportion of all the needs of an army has to be brought from other countries. The army still "goes on its belly", and though Marlborough's 'beer' has now become 'rum' and his 'beef' is enclosed in tins or frozen, yet this only complicates the question, as the 'beef' has to be carried instead of being driven 'on the hoof', as is still the custom in India, where, for reasons of caste, meat for Indian troops must be killed by the troops themselves.

In the British service the administrative service which is charged with the provision of 'supplies' (i.e. food, forage, fuel, light, and disinfectants, to use the official definition) and 'transport' is the Royal Army Service Corps; in India it is known as the Supply and Transport Corps. In former days all questions of supply, when they were attended to at all, were left to the tender mercies of a 'commissariat department', the organization of which was, to all intents and purposes, civilian, the officials being known as 'commissaries' of various grades. Sometime in the 'eighties of last century this civilian or semi-civilian department of the army was abolished, and from its ashes rose the Army Service Corps, an entirely military department. For its outstanding services in the European War the corps was awarded the prefix 'Royal'. The Royal Army Service Corps is divided into two main branches, 'supply' and 'transport'. These are again subdivided into 'companies', those of the supply branch being lettered, and those of the transport branch numbered. The transport branch is further divided into 'horse transport' and 'mechanical transport'.

All general questions of supply and transport are dealt with by the Department of the Quartermaster-General to the Forces at the War Office—the Quartermaster-General himself being a member of the Army Council—and a Director of Supplies is in charge of one of the principal subdivisions of the department.

Transportation, a system of punishment for crime by removing the criminal to a penal settlement beyond the seas. The origin of transportation is to be found in the practice formerly adopted by sovereigns of banishing for a term or for life those who seriously offended them, or of allowing those who had committed a crime and had taken sanctuary to escape abroad. The system of transportation was given statutory sanction by the Vagrancy Act of the reign of Elizabeth, and in the reign of Charles II it was extended to include, on the one hand, incorrigible rogues, vagabonds, and sturdy beggars, and, on the other hand, those who after a first conviction continued to attend illegal prayer meetings. At first those sentenced to transportation were allowed to remove themselves out of the country within a specified time under threat of hanging, but from 1718 until the American War of Independence it was the custom to transport such convicts to the American colonies, there to labour as slaves on the plantations. The system was opposed by the colonists, and with the Declaration of Independence the British Government had to seek elsewhere for a dumping-ground for its undesirables. Thus in 1787 a new penal settlement was founded at Botany Bay, in New South Wales. Though the system worked fairly well, it met with no more favour from the

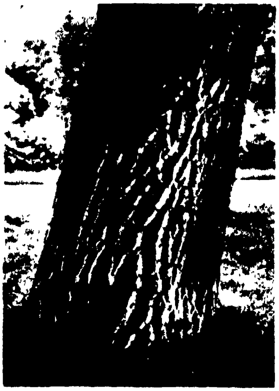
Australian than from the American colonists, and in 1840 the settlement was transferred to Tasmania. By the Penal Servitude Acts of 1853 and 1857 transportation was practically abolished, and it soon ceased entirely.



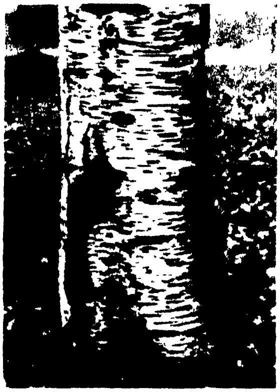
Transvaal, the north-eastern province of the Union of South Africa, bounded on the north by the Limpopo River, and on the south by the Vaal. Area, 110,450 sq. miles; pop. (1921), 2,085,840. *Physiography.*—The country is in general a plateau of 4000 feet mean elevation, but it is lower in the north and east. The High Veld, between the Vaal and the Magalies Mountains, has a height of 5000–6000 feet; the Middle Veld has a height of 4000–5000 feet. The Low Veld is low, and is the most hot, humid, and unhealthy region. The plateau is crossed by a number of mountain ranges, among which the chief are the Magaliesberg, the Witwatersrand, the Drakensberg (Mauch Berg, 8725 feet), and Zoutpansberg, the last two in the east and north-east. Rivers are mostly tributaries of the Vaal or Limpopo, but a few flow direct to the Indian Ocean (e.g. the Crocodile and the Komati, which unite and flow into Delagoa Bay, and the Pongola). The larger area drains to the Indian Ocean. *Climate.*—The extreme north of the Transvaal is within the tropical zone, but most of the country is extra-tropical, and the climate generally is modified by the elevation. The Low Veld is dominated by the tsetse fly, and is not therefore a white man's country, although its mineral wealth has done much to repay risks taken. Malaria is prevalent there also, but is milder at elevations over 3500 feet. Daily temperature ranges are very wide (from over 100° F. by day to below zero at night), but the High Veld possesses one of the finest climates in the world. *Towns.*—Pretoria is the provincial (and the Union) capital. Other towns are: Johannesburg, Benoni, Krugersdorp, Boksburg, Potchefstroom, Roodepoort, Germiston, Middelburg, and Springs. *Production.*—The High Veld is a treeless grassland suitable for cattle and sheep, but the winter months are dry and unfavourable. The Middle Veld is more limited in extent, and produces cereals, tobaccos, and fruit. The Low Veld produces gold, coal (fields at Boksburg and Middelburg), and diamonds (near Pretoria). Lourenço Marques is the outlet for the Transvaal, although it is in Portuguese territory. Most trade, however, is with the United Kingdom. There are several general manufacturing industries. On the whole, maize and tobacco are the chief crops, but the Transvaal must be considered more as a stock-raising region. Transvaal has railway communication with the rest of the Union and with the South-West Protectorate.

History. — The Transvaal first appears in history in 1836, when some of the Boers who had left Cape Colony at the time of 'The Great Trek' (see *Boers*) crossed the Vaal in order to escape from British rule. With native assistance they drove the invading Matabele across the Limpopo, and organized a republican form of government. In 1852 (Sand River Convention) Britain formally recognized their independence, but it was not till 1860 that the four Republics of Potchefstroom, Lydenburg, Utrecht, and Zoutpansberg were welded, as Transvaal, into a single republic. Three years later Pretoria became the capital. The Republic had to face many difficulties, financial and other, and Sir Theophilus Shepstone, a British Commissioner with authority from the Imperial Government, thought that in 1877 its position justified annexation, and this was accordingly declared. The Executive and the President formally protested, and it soon became clear that a large majority of the inhabitants were opposed to annexation. Had the promise of legislative autonomy, however, been carried out without delay, all might have been well, but the Boers were led by repeated refusals to take up arms, and on 13th Dec., 1880, they declared their

TREES DISTINGUISHED BY THEIR BARKS



Walnut



Birch

Lombardy Poplar

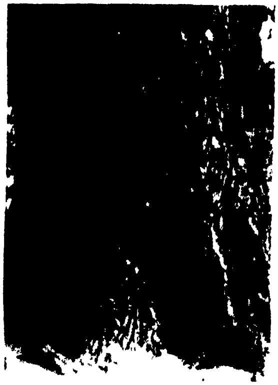
Ash

White Poplar: young tree

Sycamore

Beech

Oak



Elm

independence. For the later history, see *South Africa, Union of.*

Social Conditions.—The population is naturally very mixed. In religion the Dutch Churches have an overwhelming majority among whites, Anglicans, Jews, Methodists, Presbyterians, and Roman Catholics following in order. Among non-whites the vast majority are non-Christian; the Christians are mostly Lutherans and Methodists, with Anglican and Dutch Churches far behind. All education, except university training, is provincially organized, and there are twenty-nine school districts, Government primary and secondary schools being free. The native tongue of the scholar is taught up to the fourth standard, after which training is generally bilingual (i.e. English and Cape-Dutch).

Government.—There is an Administrator, who is assisted by a Provincial Council of 49 members, and 49 members are sent to the Union Assembly.

Transylvania, a province of Greater Roumania, formerly one of the most prosperous parts of Hungary. *Production.*—Transylvania is mountainous, and 38 per cent of the area is wooded (chiefly beech). Sheep-rearing is probably the most important industry; apiculture is highly developed; and cattle-raising is progressive, including buffaloes bred for work and milk. Horse-breeding is important, and the export of horses is large. Maize is the chief grain crop; wheat and rye (small yields), oats, barley, and beet-root are others. *Communications.*—The Transylvanian trunk line is the Budapest-Predeal railway (with branches), which is joined at Tõvis by another line from Budapest, entering Transylvania near Zám and following the Maros Valley. *Towns.*—Oradia Mare, Cluj, Arad, Sighetul Marmaţiei, Brasov, Sibiu, Turda, and Bistriţa. *Area, &c.*—Transylvania is divided into twenty-four districts for local government, and sends 45 Senators and 112 Deputies to the Roumanian Constituent Assembly. Area, 22,312 sq. miles; pop. 2,678,376. See *Roumania* (with map) for detailed physiography, &c.

History.—The history of Transylvania may be epitomized as ‘the rise of the Vlachs’. From the dawn of history there have been four contending nationalities within the region, and of these the Saxons, Magyars, and Szekels (Magyar-speaking) formed the ‘ruling-nations’, who battled among themselves for hegemony, but were ever united to keep the fourth nation, the Vlach (Roumanian), in a state of serfdom. After 1690 Transylvania fell more and more under Habsburg influence, and in 1765 was declared by Maria Theresa an Austrian Crownland, a policy of Germanization being inaugurated. However, the *Ausgleich* or compromise between the Magyars and the Habsburg dynasty incorporated Transylvania in Hungary (1867), with full and equal political rights to all nationalities. Thus, nominally, were the Vlachs emancipated, but the rising spirit of Roumanian nationalism began to inspire their kindred nationals of Roumania *irridenta*, and with the extinction of the Habsburg dynasty during the European War came definitive Vlach emancipation, union with Roumania being proclaimed at Alba Iulia in Dec., 1918. Saxon and Magyar minorities are guaranteed absolute political freedom.

Trap, a term rather loosely and vaguely applied by the earlier geologists to some or all of the multifarious igneous rocks that belong to the palæozoic and mesozoic eras, as distinct from granite on the one hand, and the recent volcanic rocks on the other. Trap-rocks of basaltic nature often assume a terraced appearance on weathering, whence their name from *trappa*, the Swedish for a stair. *Basalt* (q.v.) is the commonest of the trap-rocks. The hill-scenery of trappean districts is often picturesque, as in the north of Skye.

Trapa, a genus of plants, order Onagraceæ, consisting of several species, floating in water, and having long jointed root-stocks, with hair-like roots. They yield edible seeds. *T. natans* of Central and Southern Europe has received the name of water-caltrops from its four-horned fruits. These, which are called Jesuits'-nuts in Italy, and water-chestnuts in France, are ground into flour and made into bread in the south of Europe. *T. bispinōsa* yields the Singhara-nuts of Northern India.

Tra'pani, the westernmost province of Sicily. Area, 968 sq. miles; pop. 370,000. Trapani is the capital.

Trapani (ancient **Drepănon** or **Drepănum**), a seaport-town in Sicily, capital of the province of Trapani, on a peninsula shaped like a sickle, and hence its ancient name, from the Gr. *drepanon*, a sickle. It is on the Palermo-Marsala-Trapani coastal line, and has a cathedral of no great merit, lyceum, nautical school, &c. There is a trade in macaroni, wines, olive-oil, &c., and the fisheries are extensive. Pop. (commune), 60,779.

Trap-door Spider, a name given to certain spiders that have the habit of constructing tubular dwellings in the ground, sometimes a foot or more in depth and an inch or so in diameter, closed by a sort of hinged door. They belong to several genera, and are found in Southern Europe, Western North America, and elsewhere. The dwelling is lined with the silky substance spun by the insect, and the hinge of the door is formed of the same, the door itself being constructed sometimes of earthy particles connected by threads, sometimes of leaves, &c. Some species construct nests that have a main tube and one or more branches, the latter having a door where they join the main tube. See Plate.

Trasimene, Lake, a lake of Umbria, Central Italy. It is about 30 miles in circumference, and contains the islands of Maggiore, Minore, and Polvese. The town of Castiglione del Lago stands on a promontory on the western side. Trasimene is the *Trasimenus Lacus* of ancient times, and is especially famous on account of the great victory (217 B.C.) obtained there by Hannibal and the Carthaginians over the Roman consul C. Flaminius. This was one of the greatest defeats sustained by the Roman arms during the whole course of their history.

Trass, a volcanic product, consisting of trachytic ashes and scoriæ thrown out from the ancient Eifel volcanoes, on the Rhine, near Coblenz. It is similar to the *pozzolana* of the Neapolitans, and is used for the manufacture of cement. The same name is given to a coarse sort of plaster or mortar made from other clayey materials, used to line cisterns and other reservoirs of water.

Traun, Lake of, a lake of Upper Austria, in the Salzkammergut. The River Traun passes through the lake and enters the Danube.

Trautenau (trou'te-nou), a town of Bohemia, Czecho-Slovakia, in the valley of the Riesengebirge. It is the Bohemian flax-spinning centre. Pop. 16,143.

Travancore, a native state of India in political relations with Madras. It occupies the extreme south-west of the peninsula, and is described as 'the most beautiful and fertile area of Southern India'; area, 7594 sq. miles. There are two railway systems. Rice is the chief crop; others are: pepper, areca-nuts, cocoa, coffee, tea, cardamoms, tapioca, jack-fruit, tobacco, and oil plants. The ruler has the title of Mahárajah, and the ruling family is Hindu, sovereignty passing in the female line. Trivandrum is the state capital. Pop. 4,005,850 (nearly 70 per cent Hindu, Christians second, and Mahommedans a bad third). Over 60 per cent of the people are dependent on agriculture.

Trav'ertine, a white limestone deposited from the water of springs holding carbonate of lime in solution. Travertine is abundant in different parts of Italy, and a large proportion of the edifices of ancient and modern Rome are built of this stone. It tends to fill up valleys in the limestone lands east of the Adriatic.

Trav'esty, a burlesque treatment or setting of a subject which had been originally handled in a serious or lofty manner. The term should never be confounded with *parody,* in which, strictly speaking, the subject-matter and characters are changed, and the language and style of the original humorously imitated; whereas in *travesty* the characters and the subject-matter remain substantially the same, the language becoming grotesque, frivolous, and absurd.

Travnik, a town of Yugoslavia, in Bosnia, on the Lasva. It is mainly Mahommedan, and from 1700 to 1852 was the seat of the Turkish viziers of Bosnia. Pop. 6000.

Traz-os-Montes, an inland province of North-Eastern Portugal, draining to the basin of the Douro, which bounds it south and west, and traversed by the valleys of tributary streams, chiefly Sabor, Tuella, and Tamega. There are two districts, Braganza and Villa Real, with towns of same names. Area, 4163 sq. miles; pop. 405,750.

Tread-mill, an instrument of punishment introduced into the prisons of Great Britain in 1820, but abolished early in the present century. It consisted of a large wheel, about 20 or 25 feet wide, with steps on its external surface, upon which criminals were placed. Their weight set the wheel in motion, and they maintained themselves in an upright posture by means of a horizontal bar fixed above them, of which they kept hold. The power thus obtained was sometimes applied to useful purposes.

Treason, High. Treason (Lat. *traditio,* surrender, delivery, from *tradere,* to deliver, betray), the *crimen læsæ majestatis* of the Roman law, is that crime which is directly committed against the supreme authority of the State, and is considered to be the greatest crime that can be committed. Formerly in England certain offences against private superiors were ranked as *petit* or *petty treason,* e.g. the killing of a master by his servants; and it was in opposition to such offences that treason against the sovereign was called high treason; but by 9 Geo. IV, cap. xxxi, s. 2, high treason was made the only treason. In a monarchy it is considered to be the betraying or the forfeiting of allegiance to the monarch; but in a republic it has reference to the Government or the whole community. The present law of treason in the United Kingdom rests substantially upon the statute of the twenty-fifth year of Edward III, which comprehends the following descriptions, namely: (1) compassing or imagining the king's death; (2) violation of the king's companion (meaning the queen), his eldest daughter, unmarried, or the wife of the eldest son and heir; (3) levying war against the king in his realm; (4) adhering to his enemies in his realm, and giving them aid and comfort in the realm or elsewhere; (5) counterfeiting the Great or Privy Seal; and (6) slaying the Chancellor, Treasurer, &c. The third of the offences detailed in this statute is now treason-felony, and has a milder punishment than treason annexed to it. Clause 5 is now repealed. The English law condemns the person convicted of treason to be drawn in a hurdle to the place of execution, there to be hanged, and then beheaded and quartered; and a conviction was followed by forfeiture of land and goods, and attainder of blood; but this is now restricted to hanging, forfeiture and attainder being abolished by 33 and 34 Vict. xxiii. The concealment of treason is called misprision of treason. In the United States a citizen commits treason if he levies war against his country, or adheres to its enemies.

Treason-felony, a term commonly used to designate those offences which are pronounced felony by 11 and 12 Vict. cap. xii (1848), namely, the compassing, imagining, inventing, devising, or intending, first, to deprive the sovereign of any of the royal powers or prerogatives; or, second, to levy war within the realm in order to compel him forcibly to change his measures; or to intimidate either House of Parliament; or to excite an invasion in any of His Majesty's dominions. Treason-felony is punishable with penal servitude for life or for a term not less than seven years, or with imprisonment for a term not exceeding two years with or without hard labour.

Treasurer, Lord High, formerly the title given in England to the third great officer of State. First appointed by William I, the Lord High Treasurer was entrusted with the management of the king's exchequer. In 1612 the duties of the office were for the first time distributed among commissioners, and from the accession of George I (1714) this has been the regular practice.

Treasure Trove, coin, gold, silver-plate, or bullion found hidden in the earth or in any private place, the owner of which is not known. In Britain such treasure belongs to the Crown; but if the owner is known, or is ascertained after the treasure is found, the owner and not the Crown is entitled to it. It is, however, the practice of the Crown to pay the finder the full value of the property on its being delivered up. On the other hand, should the finder conceal or appropriate it he is guilty of an indictable offence punishable by fine and imprisonment. Coroners are empowered to inquire into cases of treasure trove.

Treasury, the State department which has charge of the national finance, supervises the expenditure of the other departments, and prepares the annual Budget of national income and expenditure. The political head of the Treasury is the Chancellor of the Exchequer, with whom is associated the Financial Secretary to the Treasury. Nominally the Treasury is governed by a Board of Lords Commissioners, but the Board never meets. The office of First Lord of the Treasury is a sinecure, usually held by the Leader of the House of Commons, or the Prime Minister. The Patronage Secretary of the Treasury is the chief whip of the party in power in the House of Commons; and the Junior Lords of the Treasury are the junior whips.

The permanent staff of the Treasury is recruited from those who take the highest honours in the Civil Service Examination, and some of the ablest public officials are always to be found in that department. The business of financing the European War put an enormous strain upon this branch of the public service, from which it emerged with an enhanced reputation in financial circles at home and abroad. Among the new functions of the Treasury, necessitated by the exigences of war, are the issue of currency notes and a much closer supervision of the operations of the Bank of England than has been customary hitherto.

Trebbia, a river of North Italy, which rises in the Apennines, and flows into the Po near Piacenza after a course of 55 miles. Here Hannibal defeated the Romans in 218 B.C.

Trebizond′ (ancient **Trapezus**), a seaport-city of Asia Minor, on the Black Sea. It occupies a plateau sloping to the sea, and bounded on either side by steep-walled valleys. Trebizond has always been an important place because of its position as an outlet for the European trade of Persia and Central Asia, but its position was assailed by the Transcaucasian Railway (Batum-Baku), which assisted partially in diverting this trade to Russian hands. The roadstead is small and unsafe, and Platana (7 miles west) is more favoured in winter. North-Eastern Asia Minor depends on Trebizond for an outlet to the sea. The city has a dockyard, tannery, dye-house, and wool-, silk-, and linen-factories. There is a Euxine fishery. Sheep, hides and skins, tobacco, and hazel-nuts are exported in normal times, mainly to European Turkey, France, Central Europe, and Russian states. Cottons, flour and meal, grain, cloth, and sugar are received from Great Britain, Turkey, France, and Central Europe. Persian goods in transit are usually carpets, silk, and dried fruits. Caravans leave for Erzerum, Tabriz, and Syria. Pop. 55,000.

Trapezus originated in a colony founded on the coast of Pontus by the Sinopians, and derived its name from its location, although Trapezus in Arcadia pretended to be the mother-city. It flourished in the time of Xenophon, but did not achieve actual greatness until the Roman period, when it was made by Hadrian capital of Pontus Cappadocicus. After a period of over two centuries as capital of an independent principality founded by Alexius Comnenus, during which it survived the fall of Constantinople, it eventually fell to the Turks under Muhammad II (1460), and since that time it has been a Turkish city, excepting a short period of Armenian domination subsequent to the Treaty of Sèvres (1920).

Trede'gar, an urban district and market town of Monmouthshire, England, on the Sirhowy. There are steelworks and ironworks, and coal is worked in the vicinity. Pop. (1921), 25,000.

Tree, Sir Herbert Beerbohm, British actor-manager, born 1853, died 1917. The son of a London merchant, Tree was a half-brother of Max Beerbohm, a noted caricaturist and dramatic critic, and made his début in London (1878), scoring a great success (1884) as the curate in *The Private Secretary*. In 1887 he began his first venture in management, and was eminently successful in melodrama, comedy, romance, and tragedy alike. His greatest successes, however, are considered to be his Shakespearean portrayals. In 1909 he was knighted. After the death of Sir Henry Irving, Tree was acknowledged as the head of the profession; and *Macbeth* (1911), *Othello* (1912), *Joseph and his Brethren* (1913), and *Pygmalion* (1914) showed him at his best. During the European War he was an active propagandist, especially in the United States.—Cf. Max Beerbohm, *Herbert Beerbohm Tree: some Memories of him.*

Tree, a perennial plant having a woody trunk from which spring branches having a structure similar to the trunk. Trees are thus distinguished from shrubs, which have perennial stems but have no trunk properly so called; and from herbs, whose stems live only a single year. It is difficult, however, to fix the exact limit between trees and shrubs. Trees are both monocotyledonous and dicotyledonous, by far the greater number both of individuals and of varieties belonging to the latter class. Those of which the whole foliage falls off periodically, leaving them bare in winter, are called *deciduous*; those of which the foliage falls only partially, a fresh crop of leaves being always supplied before the mature leaves are exhausted, are called *evergreen*. Trees are the longest lived organisms of the vegetable kingdom, and attain a great and indefinite age, far exceeding that of animals. See *Botany*; *Sylviculture*; *Timber*.

Tree-crab, a crab of the genus Birgus, included among the land-crabs. It breaks open the shell of the coco-nut, &c., by repeated blows of its great claws, in order to feed upon the soft pulp of the nut. One of the claws is narrow and used for perforating the soft spot in the shell. Tree-crabs can live for long periods out of water, but deposit their eggs in the sea.

Tree-ferns, the name given to several species of ferns which attain to the size of trees, as the *Alsophila vestīta*, *Cibotium Billardieri*, &c. They are found in tropical countries. A handsome species, *Cyathea medullāris*, contains in its trunk a mucilaginous pulp comparable to sago, which is used extensively for food in Polynesia and New Zealand.

Tree-frog, a name of frogs differing from proper frogs in the extremities of their toes, each of which is expanded into a rounded adhesive disc, that enables the animals to adhere to the surface of bodies and to climb trees, where they remain during the summer feeding upon insects. *Hyla arborea*, the only European species, is common in France, Germany, and Italy.

Trefoil, a distinctive title applied to plants of various kinds on account of a peculiarity of the form of the leaf, which consists of three leaflets; examples, buck-bean, clover, and medick. The same term is also applied to an ornamental foliation in Gothic architecture, used in the heads of window lights, tracery, panelling, &c.

Treitschke, Heinrich Gotthard von, German historian and political writer, born 1834, died 1896. The son of a Saxon officer, he was educated at Leipzig and Bonn. Strong liberal opinions, later outgrown and changed to an extravagant devotion to the Hohenzollern line, at first debarred him from a professorship; but he subsequently held chairs at Freiburg (1863), Kiel (1866), Heidelberg (1867), and Berlin (1874). He was also prominent in journalism. In 1871 he entered the Reichstag. To an enthusiasm for German colonial expansion Treitschke added a bitter enmity towards Britain and her policy. His outstanding work is the *Deutsche Geschichte im 19. Jahrhundert*, a powerful though ill-constructed work which brings German history down to the year 1848. There is an English translation.

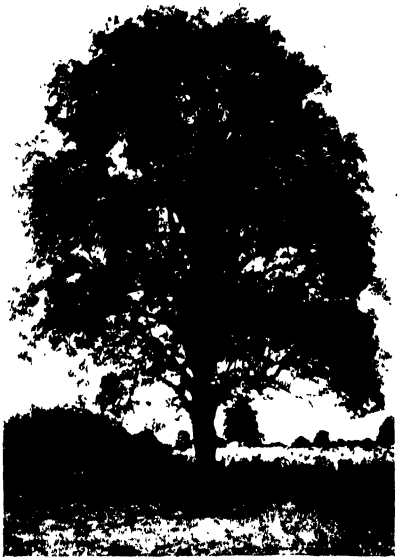
Tremato'da, a division of the phylum Platyhelmia or flat-worms, and represented by such forms as the flukes or Distoma (see *Distomum*) and their allies. They are parasitic worms, usually of a flattened or rounded form, and are furnished with one or more suctorial pores, like minute cupping-glasses, for adhesion to the tissues of their hosts.

Tremellineæ, a primitive family of basidiomycetous Fungi, distinguished by their basidia being vertically four-chambered. Tremella is the type-genus. The pale-yellow shapeless gelatinous fruit-bodies of *T. lutescens* are not uncommon on dead wood.

Trem'olite, a mineral, one of the amphiboles. It is a silicate of calcium and magnesium, is white or colourless, and usually occurs in long, prismatic crystals.

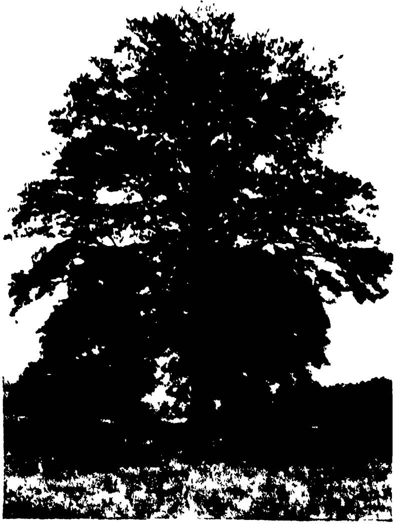
Trench, Richard Chenevix, British divine, poet, and philologist, born in 1807, died in 1886. Educated at Trinity College, Cambridge, he was curate to Archdeacon Wilberforce and rector of Itchenstoke, and became professor of theology

Lombardy Poplar

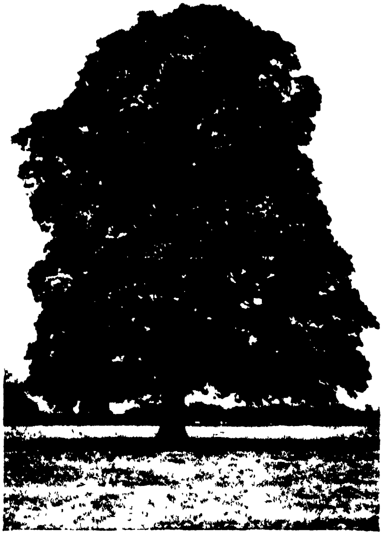


Ash

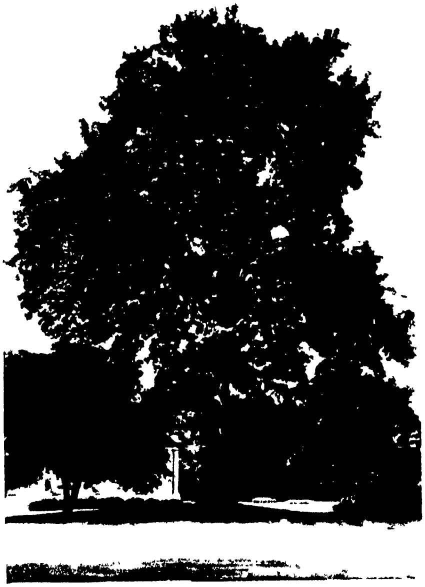
Lime



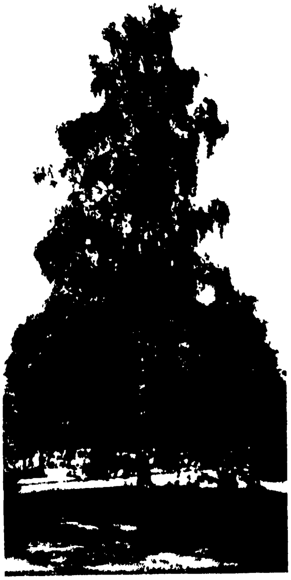
Beech



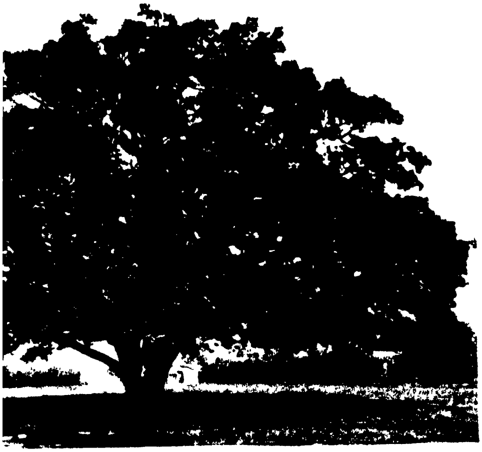
Sycamore



Plane

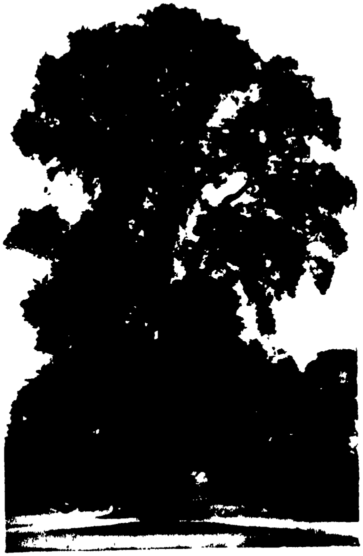


Birch



Oak

From photographs by Henry Irving

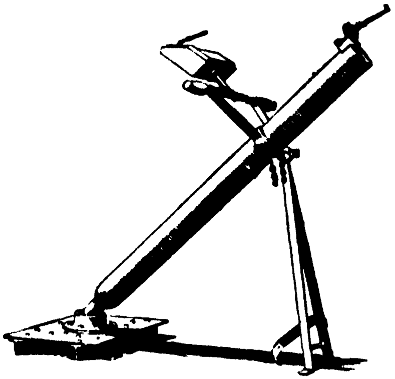


Elm

at King's College, London, in 1846. Dean of Westminster from 1856 to 1863, he was consecrated Archbishop of Dublin, 1st Jan., 1864. Ill health forced him to resign the archbishopric in Nov., 1884. His works include: *Notes on the Parables* (1841), *Notes on the Miracles* (1846), *On the Study of Words* (1851), *Proverbs and their Lessons* (1853), *Synonyms of the New Testament* (1854), *English Past and Present* (1855), *On Plutarch* (1874), and *Lectures on Mediæval Church History* (1878).

Trench Fever, an infection communicated through the instrumentality of lice, and marked by an abrupt onset of fever, headache, muscular pain of varying severity, a mild inflammation of the conjunctiva, and a tendency to periodic relapse. A rash has been observed, fleeting in character, less pink than in typhoid fever, and composed of larger spots than in that disease. Three types of the acute disorder have been described: (1) a short form, subsiding in from four to six days; (2) a type with which prolonged fever is associated; and (3) a relapsing form. Appearing among the troops on the Western Front at the end of 1914, the first type gave way to the second and third in the later years of the European War. During and after 1917, type (2) was more prominently noticed than type (1); but in 1918 about 70 per cent of cases were of the relapsing type. It has been computed that nearly one-quarter of the sick wastage in France during the war was due to trench fever. About 8 per cent of the cases became chronic. A strong tendency to involvement of the heart was observed in these and also in some acute cases. Neurasthenia in predisposed persons is also favoured by the infection. In 1919 regulations issued by the Local Government Board (afterwards the Ministry of Health) laid upon medical officers of health the responsibility of securing as far as possible that the disease should not become endemic in Great Britain. Latency for so long as four years after infection has been recorded. In such cases each successive attack seems to be less severe. Apart from symptomatic treatment of the individual, disinfestation and disinfection are essential for prophylactic reasons. It is not certain whether any fever described before 1914 was identical with trench fever.

Trench Mortars. During the European War the necessity for cover of some kind soon made life underground compulsory, and it immediately became evident that, if the war was to go on, some new form of weapon must be devised to supplement the rifle and the field-gun, some weapon which could be counted on to carry death and destruction into a deep and narrow trench from short range. Bombs and grenades had already appeared and catapults followed, but these had a very limited scope. What was demanded was a powerful projectile and a suitable weapon to propel it slowly into the air, so that it would drop at a steep angle right into trenches or upon the roofs of dugouts. Various experiments with mortars built on the lines of ancient cannon, and projecting a large and heavy bomb, were tried; and the Germans used a large round bomb attached to a stick. The stick fitted into the barrel of a short mortar having the bomb sitting on the muzzle; a small propellant charge only was used, and the bomb sailed slowly through the air, and exploded with a terrific effect when it struck the ground; the rate of fire of this variety was slow.



Trench Mortar. Anti-aircraft M. L. Stokes 3 inch

Then in 1915 Mr. Stokes, of the Ransome Agricultural Machinery Company, began to experiment with a trench mortar, since known as the Stokes gun. This perfected mortar with its special projectile has proved to be the best-known weapon of its kind, and all its types are of great use in open and trench warfare, whether in attack or defence. The inventor's object was to produce a mortar having the following essential qualities: (1) light, portable, easily set up; (2) accurately laid by a simple angle; (3) a fair range; (4) useful behind cover, and in the open; (5) having the shell and propellant as nearly as possible in one unit; (6) capable of giving a rapid rate of fire. He was successful in meeting all of these requirements.

The Gun.—The gun consists of a steel tube of various diameters, according as it is a light, medium, or heavy mortar. The bottom end is reinforced to stand the explosion of the charge, and has a steel spike projecting up from it; this acts as a striker. A steel plate is sunk or laid on the ground, against which the end of the gun is placed to prevent it drilling into the ground on discharge. The front end is supported by a tripod, which can be adjusted to almost any angle up to about 85°. The shell is most ingenious, consisting of a cast-iron pointed cylinder with a smaller hollow cylinder projecting from the base to take the propellant. The propellant consists of nothing more or less than a form of sporting cartridge inserted in the bottom cylinder; it can be augmented to give a longer range by putting rings of cordite round the original charge to make it more powerful. The gun is laid to the proper angle, and is fired by the gunner dropping the shells down the mouth base first; this can be done, if necessary, as fast as they are passed to him. The cap on the cartridge strikes the steel spike on the bottom of the tube, and is thus fired by its own weight. With a good team great rates of fire can be obtained, sometimes up to 30 rounds a minute, but owing to the weight of ammunition and difficulty of transport this rate is not often used. The shell is charged with different kinds of explosive according to what is required, ammonal, amatol, and sometimes thermite for incendiary purposes, and also for creating smoke.

Trent, a river of England which rises in Staffordshire, flows through the counties of Stafford, Derby, Nottingham, and Lincoln, and falls into the Humber after a course of 144 miles. A navigation scheme will make the Trent navigable for barges of 120 tons between Nottingham and the sea (96 miles), where special facilities exist for barge-loading at Hull.

Trent, Council of, an œcumenical council of the Roman Catholic Church, convened to settle various controversies that were agitating the Church during the Reformation period, and for the reform of abuses. It met at Trent in 1545 during the pontificate of Paul III, but the wars in Germany caused its transference to Bologna in 1546, when it dispersed. Pope Julius III again convoked it at Trent in 1551, but it dispersed a year later on the approach of the Lutherans. Eight years afterwards it was again called together by Pius IV, and it finished its labours in 1563. This council definitively settled the doctrines of the Roman Catholic Church. Its decrees are embodied in what is known as the Creed of Pius IV.

Trentino, a northern frontier province of Italy. Including the Alto Adige, it is largely mountainous, and has exits by the Brenner Pass (central; 4500 feet), Reschen Pass (western; 4960 feet), and Toblach Pass (eastern; 3980 feet). The northern end of Lake Garda is within the province, which belongs almost entirely to the basin of the Adige, along the valley of which, with its tributaries, the population is mainly concentrated, although there are few inhabitants above 4300 feet altitude. All the rivers are torrential, even the Adige, which is under 100 yards wide in the Trentino, and also the second largest river, the Brenta. The Sarca rises on the western frontier and falls into Lake Garda. Climatically the province varies between the warm shores of Garda and the frozen, glacial valleys of the mighty snow-capped mountains.

Area, &c.—The total area is about 4027 sq. miles and the pop. 648,200. Towns include those at the junction of transverse valleys with the longitudinal valleys, and their importance arises from their control of the only natural outlets; such are: Bressanone (or Brixen), at the confluence of Rienz (which flows along the Val Pusteria) and Isargo; Merano (20,000), at the confluence of Passiero and Adige; Bolzano, capital of Alto Adige, at confluence of Tolferbach and Isargo, above Isargo-Adige confluence; Trento, at mouth of Fersina, the provincial capital; Roveredo (12,000), at Leno-Adige confluence; Riva (1000), on the shores of Lake Garda; and Levico (9000). The chief mineral springs and spas are Merano, Riva, Arco, and Levico.

Communications.—The famous Brenner railway line from Innsbruck (Tirol) crosses the frontier at Brennero, and runs down the Adige Valley through Bolzano, Trendo, Roveredo, and Mori to Verona (in Venetia).

The length (Brennero to Verona) is 150 miles (see *Tirol*). From Bolzano a branch is thrown off to Merano, and along the Val Venosta to Mals; length, 64·5 miles. A mountain line runs between Trento and Malé, via Mezolombardo; length, 44 miles; and another between Trento and Venice, via Levico, Borgo, and the Brenta Valley; length, 105·75 miles. Riva is served by a branch of the Brenner line running from Mori, via Arco; length, 15·5 miles.

The People.—The Trentino and Alto Adige are geographically one but ethnologically divided. In the Trentino Italians predominated at the Austrian census of 1910, but only in the Ampezzo district of Alto Adige did they show a majority over the German element. As the Treaty of St. Germain-en-Laye was drawn up with an eye to ethnologic justice, the frontier of Italy now includes as few other nationals as is humanly possible, and it is therefore considered as being satisfactory. Pellagra is endemic. Of the people, only about 12 per cent are urban, and the vast majority are small farmers.

Production.—Silk is produced, and the mulberry tree is widely cultivated. The Trentino supplied 90 per cent of Austrian cocoons before the European War. Cattle-raising is progressive; fruit is raised on the shores of Lake Garda (oranges, lemons, and olives) and in the sheltered valleys elsewhere (apples, pears, plums, quinces, &c.). The vineyards of the Adige Valley, the Val di Non, and Val Sugana are noted; vines are planted up to 2000 feet, and the mulberry trees form a fringe above them. About 87 per cent of Trentino is productive. Forests are thickest around Riva, and rivers and tarns are rich in fish. Minerals are practically unexploited, but reputed rich, and there is an abundance of medicinal springs, chiefly iron. Trentino's greatest asset is probably the enormous amount of potential hydro-electric power that flows daily through her afforested valleys. (See *Tirol.*)

Modern History.—The region passed to Austria after the downfall of Napoleon, and (1814) became a part of Tirol, which it remained until the European War, when by a secret treaty, in which Britain and France guaranteed the Trentino to Italy (26th April, 1915), that country broke her connection with the Triple Alliance. The region passed to Italy by the Treaty of St. Germain-en-Laye (1919).

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Trento (Ger. *Trient*, Lat. *Tridentum*), a town of Italy, on the Adige, the capital of Trentino. It is a place of great antiquity, having been made a bishopric before 380. Pop. 30,000.

Trenton, a city of New Jersey, United States, the state capital and county seat of Mercer county, on Delaware River; served by the Pennsylvania and the Philadelphia & Reading Railways, and by Delaware-Raritan Canal. Trenton is the greatest producer of pottery in the United States, and has developed into a great industrial metropolis through the organization of its transport systems by rail and water—it is at the head of navigation on the Delaware River—and through its proximity to the great Pennsylvania coal-fields. Settled in 1676, it became state capital in 1790, and was chartered as a city in 1792. Pop. 119,300, (fourth largest city in New Jersey).

Trepang, the sea-slug, a marine animal of the genera Holothuria and Stichopus, belonging to the phylum Echinodermata, class Holothuroidea, popularly known as 'sea-cucumbers', or bêche-de-mer. It is found chiefly about coral reefs in the Eastern seas, and is a rather repulsive-looking animal, somewhat resembling the land-slug in shape, and varying in length from 6 to 24 inches. Sun-dried trepangs are in special request in China for making soups. The fishery is carried on in numerous localities in the Indian Ocean, the Malay Archipelago, and on the coasts of tropical Australia.

Trepanning, in surgery, the operation of cutting an opening into the skull by means of a *trepan*, or boring instrument, with which several holes are made in a circle, the intervening bone being then removed. See *Trephining.*

Trephin'ing, one of the several modern methods for gaining access to the brain or its membranes, to relieve the organ from pressure, arrest hæmorrhage, evacuate an abscess, or remove a tumour. The instrument used, the *trephine*, consists of a handle, to which is fixed a small hollow steel cylinder, of about ½ to 1 inch diameter, having teeth cut on its lower edge so as to form a circular saw.

Trespass, in law, a term which is applied generally to any offence against the person or property of another, but is more especially applied to a peaceable but unlawful entry upon the property of another, the remedy for which in English law is by an action of damages. Any injuries committed against land or buildings are in the most ordinary sense of the word trespasses, as entering another's house without permission, walking over the ground of another, or suffering any cattle to stray upon it, or any act or practice which damages the property, or interferes with the owner's or occupier's rights of possession. A creditor or customer can be ordered away by a householder or shopkeeper, and even the civil courts have no power to give a right of entry to officers entrusted with the execution of legal processes, though such officers may maintain possession if once they gain entrance. Of course, there is no trespass when one enters upon the land or buildings of another in exercise of a right, or in the enjoyment of an easement. Trespassers in pursuit of game are liable in Britain to summary prosecution under the game-laws.

Trevel'yan, The Rt. Hon. Sir George Otto, Bart., British author and politician, the only son of Sir Charles E. Trevelyan, and nephew of Lord Macaulay, born in 1838. Educated at Harrow, he graduated at Trinity College, Cambridge, and entered the Indian civil service by competition. He was a member of Parliament from 1865 to 1897, and except for a short interval always followed Gladstone's lead. He held the following official appointments: Lord of the Admiralty (1868–70), Secretary to Admiralty (1880–2), Chief Secretary for Ireland (1882–4), Chancellor of the Duchy of Lancaster (1884), and Secretary for Scotland (1886 and 1892–5). In 1911 he was created O.M. He is author of the *Life and Letters of Lord Macaulay*, *The Early History of Charles James Fox*, *The American Revolution*, and *Interludes in Prose and Verse*, &c.

Trevi'so, a province of Venetia, North Italy. Area, 956 sq. miles; pop. 525,000.

Treviso (ancient Tarvisium), a town of Italy, capital of the province of Treviso, on the Sile; the junction for Vicenza, Belluno, and Motta di Livenza, on the Venice-Udine Railway. The manufactures consist chiefly of silk and cotton goods, machinery, and cutlery. During the European War Treviso was a base of the Italian army (1915–8). Pop. (commune), 48,597.

Trev'ithick, Richard, British engineer and inventor, born in Cornwall 1771, died 1833. In

1797 he succeeded his father as a leading engineer in Cornish mining. Among his first inventions was an improved pump, which soon came into universal use in deep mining. He next perfected a high-pressure steam-engine, and began to experiment in the construction of locomotive engines. Passengers were first conveyed by steam by means of his road locomotive in 1801, and he soon after successfully worked a tramroad locomotive. His ideas were afterwards taken up and developed by Stephenson. He was the first to recognize the value of iron in shipbuilding, and the application of steam to agriculture. His request for recognition and reward for his numerous inventions was disregarded by Government.—Cf. S. Smiles, *Lives of the Engineers*.

Trial, the judicial examination of a cause. It may take place before a judge and a jury or (more frequently) before a judge alone. Briefly, the procedure at a trial is as follows. Counsel for the party on whom rests the burden of proof (usually the plaintiff) leads in the proof. He opens with a speech setting forth the facts on which he relies and which he hopes to prove. He then calls his witnesses, who are in turn examined by him for the purpose of eliciting these facts; cross-examined by the opposing counsel with a view to breaking down their evidence, destroying their credibility, or obtaining useful admissions; and re-examined by the former counsel on any fresh points brought out in the cross-examination. The judge may also put questions to the witnesses. Counsel for the other party then opens his case and calls his witnesses, who are examined by him, cross-examined by his opponent, and, if necessary, re-examined in similar manner. He thereafter addresses the court on the evidence, and counsel for the leading party replies. The judge sums up. If there is a jury, he directs it on the law, and he may give a résumé of the whole evidence and express his opinion. The function of the jury is to find a verdict on the facts. The judge decides questions of law and gives judgment.

In Scotland the procedure is very similar, but there are no opening speeches, and counsel for the defender in the action or the issue has the last word before the summing-up of the judge.

Trias, or **Triassic**, the name of the geological system and period which open the Mesozoic group and era. The beds of this period are poorly represented in Britain, where they were deposited under continental and semi-arid conditions, and are often styled the New Red Sandstone. In Central Germany, a marine zone, the *Muschelkalk*, intervenes between the *Bunter* series and the *Keuper* beds above. But in the Eastern Alps there is a continuous marine sequence, with numerous ammonites, closing with the *Rhætic* series. The period is noteworthy for the rise of the reptiles, including dinosaurs, as the dominant forms of life.

Tribe, a group of individuals linked together by cultural and linguistic bonds, occupying a certain territory and claiming a common ancestor. It is thus a political group presupposing an ethnical relationship. Next to the family, the tribe is the simplest social-political unit. An aggregate of families, or communities, under one chief, constitutes a tribe, whilst the coalescence of tribes, in the same area and under the same government, forms a state, or, if the tribes be related, a nation.

Tri'bune (*tribūnus*), in Roman antiquity, originally an officer connected with a tribe, or who represented a tribe for certain purposes; especially, an officer or magistrate chosen by the people to protect them from the oppression of the patricians or nobles, and to defend their liberties against any attempts that might be made upon them by the senate and consuls. These magistrates were at first two, but their number was increased to five and ultimately to ten. This last number appears to have remained unaltered down to the end of the Empire. There were also military tribunes, officers of the army, each of whom commanded a division or legion, and also other officers called tribunes; as, *tribunes* of the treasury, of the horse, &c.—Cf. A. H. J. Greenidge, *Roman Public Life*.

Triceratops, a gigantic horned dinosaurian reptile, herbivorous, but heavily armoured, with a collar-like expansion at the back of the skull, set with formidable spikes. It occurs in the latest Cretaceous strata of North America.

Trichina (tri-kī'na), a minute nematoid worm, the larva of which was discovered in 1835 in the tissue of the voluntary muscles of man, giving rise to the disease known as *trichiniasis* (q.v.). The worm is common also to several other mammals, and especially to the pig and rat, and it is generally from the former that man receives the disease. When a portion of pork containing larvæ is taken into the stomach, the larvæ in a few days become developed into procreative adult worms, having in the meantime passed into the intestines. The male worm is about $\frac{1}{20}$th of an inch long, the female about a half more. The female produces embryos in extraordinary numbers, which gain entrance into the muscles by penetrating the mucous coat of the intestine and entering the capillaries, whence they are carried to their habitat by the circulation. In the muscles they become quiescent, are encased in a cyst covered with calcareous matter, and may give no more trouble.

Trichiniasis, **Trichinelliasis**, or **Trichinosis**, is a disease caused by the parasitic worm *Trichinella spiralis* (see *Trichina*). Infection in man is due to eating pork containing the encysted larva. The parasite passes the three stages of its life-history, as adult, embryo, and encysted larva, in the human body, and the symptoms of the disease occur roughly in three stages corresponding to these. The first stage is one of gastro-intestinal irritation, associated with severe pain, vomiting, and diarrhœa, and at times so severe as to resemble the onset of cholera. After about one week the second stage begins, and it is a period of general infection, with characteristic tender swollen muscles, causing such pain on movement that the patient lies motionless with limbs partially flexed. There is high remittent fever, with insomnia, delirium, and often marked difficulty in breathing, while bronchitis and congestion of the lungs are a common and dangerous complication. The third stage shows a gradual lessening of all the symptoms, due to the death of the adults and the encystment of the embryos. There is at this stage marked wasting, and the patient is much debilitated. Treatment at first should be vigorously carried out in order to kill the parasite, but after the general infection has taken place this is useless, and only palliative measures to maintain the patient's strength are of any use. Preventive measures regarding the feeding of pigs and thorough cooking are the most effective means of avoiding the disease. It is most often found in Germany, North America, Holland, and Scandinavia, while it is rare in Great Britain and France.

Trichinop'oly, an inland district and city of Madras, India. The district is generally an undulating plain traversed from west to east by the Cauvery, and served by the South Indian Railway (main line). Cereals, pulses, chillies, cotton, plantains, ground-nuts, betel-leaf, coconuts, hides, castor-oil, saltpetre, &c., are exported. The city is the district head-quarters, and is a noted cigar-making centre as well as the metropolis of general trade. It is a great educational centre. Area (district), 4935 sq. miles; pop. 2,100,000; pop. (city), 104,300.

Tridymite, a mineral formed, like quartz, of silica, but crystallizing in small six-sided plates, and with a specific gravity of only 2·3. It occurs in many rhyolitic lavas. When powdered quartz is heated to 870° C., it passes into tridymite. See *Cristobalite*.

Trier, or **Trèves** (Lat. *Augusta Trevirorum*), a city of Rhenish Prussia, on the Moselle; a junction on the Cologne-Saarbruck line of the State Railways, whence branches run to Coblenz, Metz, Luxemburg, Hermeskeil, and Bullay. It is considered the oldest city in Germany, and has many Roman remains, including amphitheatre, Porta Nigra (Black Gate), Imperial palace, baths, &c. The Roman Catholic cathedral, finished in 1196, containing the Holy Coat (q.v.); the Basilica, begun by Constantine the Great; and the former archiepiscopal palace, later a military barracks, are interesting features. Trier is of great commercial importance, manufacturing industrial machinery of all kinds, cloth, tobaccos, leathers, beers, furniture, &c., and there are wine and fruit markets. Pop. 58,250.

Originating as capital of the Treviri, a Belgic tribe conquered (56 B.C.) by Cæsar, Trier ultimately became the administrative centre for Roman Gaul, Britain, and Spain, and was the residence of Constantine the Great between 305–306 and 331. Temporal power was gained by the Archbishop of Trier in 898, and his successors seldom moved in their spiritual office without an eye to possible gain in temporal sovereignty. From 1315 Trier ranked after Cologne and Mainz, respectively, in the electoral college. During the Thirty Years' War the Elector Philip favoured France, and the city suffered much from all the belligerents. The electorate-archbishopric became extinct with Clement-Wenceslaus (1768–1802), and in 1821 a bishopric suffragan to Cologne was erected, having nearly the same territorial dimensions as the old archbishopric.

Trieste (ancient **Tergeste**), a seaport of Istria, Italy, formerly an Austrian crown-land and the chief seaport of the Austrian Empire, on the Gulf of Trieste, an arm of the Adriatic; served by the railway from Venice, via Udine and Cormons.[1] Trieste is the natural outlet for Central Europe and for a large part of Southern Germany. It has been a shipbuilding centre from Roman times, and the modern yards employ upwards of 12,000 men. The port comprises three divisions: (1) the Porto Vecchio, an improved port once used by the Romans; (2) the Porto Nuovo di St. Andrea, which owes its existence to the traffic brought by the Tauern Railway; and (3) the Porto Nuovo, an extension of the Porto Vecchio, completed in 1857 on the arrival of the Südbahn. It abuts the main (*Meridionale*) station. There is an arsenal; dry-docks, &c., also exist. Trieste is an industrial city, with brewing, cement, coffee, jute, marble, linoleum, and other manufactures; there are rice-mills, oil-refineries, and ironworks (also at Servola). The enormous variety of commodities passing into and out of the city defies imagination; among exports are: coffee, rice and oil (mainly to the Balkans and the Levant), tobacco, rice starch, sugar, timber, cotton yarns, iron and hardware, paper, clothing and woollens, magnesite, glassware, and beer; and imports include: raw cotton, oil-seeds, jute, wool, tea, fish, nickel, boilers, ship fittings, coal, coffee, hides and skins, rice, copper, cereals in general, tobacco, and fruit.

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[1] Trieste is served by what was the Austrian Südbahn from Vienna, via Laibach and Sankt Peter (see *Styria*). There is a line from Trieste to Parenzo (95 miles), one to Opčina (a mountain railway, 4 miles long), and a 'white elephant' ex Trieste, via Capodistria, Porto Rose, Buje, Grisignano, and the Quieto Valley to Parenzo. This last taps a region that is already better served by sea. The Tauern Railway (see *Salzburg*), running via Gorizia over the Karst (1000 feet altitude) to Opcína and Trieste, and the Suez Canal were vital factors which helped to raise the city from a mere hamlet to a first-class port. The Tauern line was opened in 1909. See *Systems*, *Railway*, paragraph 6, section (*h*).

Nationalities.—As the peace following the European War (1914–8) was more or less patched up on a basis of nationalism, Trieste naturally came much into the limelight on account of the figures (below) revealed by the Austrian census of 1910:

Nationality.	Number.
Italian	118,959
Slovene	56,916
German	11,856
Others	3,182
Total	190,913

By the Treaty of St. Germain-en-Laye (10th Sept., 1919) the city finally passed to Italy. Pop. 229,500 (approximately; this refers to the area of 37 sq. miles in the old Austrian domains).

Trigger-fishes (Balistes), a genus of teleostean fishes, so named from the peculiar structure of the dorsal fin, the first ray or spine of which can only be depressed by the movement of the second ray—the mechanism being thus like that of a gun-trigger.

Trigonometry, in the literal and original sense of the word, is the science of the measurement of triangles. In order to construct a triangle, it is not necessary to know the values of all its 'parts', i.e. its three sides and three angles. If the three sides, for example, are known, the triangle can be drawn, and the angles found by measurement. There must therefore be some analytical formula connecting the value of an angle with the values of the three sides. The investigation of formulæ of this type is one of the main objects of elementary trigonometry. It turns out that the relations sought do not give, in terms of the sides, the angles themselves, i.e. the numbers which represent the angles in degrees or radians, but certain functions of these numbers. Thus if A is an acute angle of the triangle ABC, and if D is the foot of the perpendicular from C to AB, we have, by *Euclid*, ii, 18, $\mathrm{AD}/\mathrm{AC} = (\mathrm{AC}^2 + \mathrm{AB}^2 - \mathrm{BC}^2)/(2\mathrm{AB}.\mathrm{AC})$, so that, when the sides are given, the ratio AD/AC is known; and, by the properties of similar triangles, this is a function of the angle A alone.

The trigonometrical functions thus introduced are found to have applications far transcending mere geometry, so that it has become the practice even in elementary teaching to define them for *all* values of the number on which they depend. We have first to show how this number, which may be positive or negative, can be represented graphically by an angle. Take rectangular axes X′OX, Y′OY, and with centre O and any radius r draw a circle cutting these axes at X, Y, X′, Y′. To represent a positive number θ, let a radius of the circle, starting from the position OX, revolve through an angle of θ radians (see *Degree*) counter-clockwise; if θ is negative, make the radius revolve through $(-\theta)$ radians clockwise. Let the co-ordinates of the point P, on the circle, at which the end of the moving radius arrives, be x, y. Then we take for definitions of the functions *cosine* and *sine*,

$$\mathrm{cosine}\theta = x/r,\ \mathrm{sine}\theta = y/r;$$

or, as they are usually written for brevity,

$$\cos\theta = x/r,\ \sin\theta = y/r.$$

The number r is always taken positive; x and y are positive or negative according to the position of P, x being positive when P is to the right of Y′OY, and y positive when P is above X′OX. Besides the *sine* and *cosine*, certain other functions are in common use. Their definitions are: $\tan\theta = \sin\theta/\cos\theta$, $\cot\theta = \cos\theta/\sin\theta$, $\sec\theta = 1/\cos\theta$, $\operatorname{cosec}\theta = 1/\sin\theta$. Of these four functions the *tangent* is the most important; the *secant* and *cosecant* seldom occur. Many important properties of the functions follow at once from the definitions, e.g.:

$$\sin^2\theta + \cos^2\theta = 1; \quad \sin(\tfrac{1}{2}\pi - \theta) = \cos\theta;$$
$$\sin(\pi - \theta) = \sin\theta;$$
$$\cos(\pi - \theta) = -\cos\theta; \quad \sin(-\theta) = -\sin\theta;$$
$$\cos(-\theta) = \cos\theta;$$
$$\sin(2\pi + \theta) = \sin\theta; \ \cos(2\pi + \theta) = \cos\theta.$$

The last two equations show that the sine and cosine are *periodic* functions, their period being 2π. If the argument of the function is understood to be an angle, it is not necessary that the angle should be expressed in radians, and in geometrical applications it is usually expressed in degrees, so that we have such equations as $\cos(90^\circ - \mathrm{A}) = \sin\mathrm{A}$, $\tan(180^\circ + \mathrm{A}) = \tan\mathrm{A}$.

The relations between the sides and angles of a triangle ABC are easily found from a figure. If a, b, c are the lengths of the sides opposite the angles A, B, C respectively, we have $\cos\mathrm{A} = (b^2 + c^2 - a^2)/(2bc)$, with two similar equations; when the sides are given, this determines A, with the help of a table of cosines. An equivalent form is $a^2 = b^2 + c^2 - 2bc\cos\mathrm{A}$; this gives the third side when two sides and the included angle are known. Another important set of relations is: $\sin\mathrm{A}/a = \sin\mathrm{B}/b = \sin\mathrm{C}/c$; when two angles and a side are given, these determine the remaining sides. By means of the above equations, any triangle can be *solved*, i.e. given a sufficient number of sides and angles, the rest can be found. In the process of solving triangles, formulæ suitable for working with logarithms are almost always used; the important case of two sides and the contained angle (say b, c, A) being given is solved with the help of the formula $\tan\frac{1}{2}(B - C) = \cot\frac{1}{2}A(b - c)/(b + c)$.

The development of the more analytical part of trigonometry starts with the *addition theorem*, $\cos(A + B) = \cos A \cos B - \sin A \sin B$, which is easily proved by geometry for all values of A and B, and which leads to the similar formula $\sin(A + B) = \sin A \cos B + \cos A \sin B$. If we denote the symbol $\sqrt{-1}$ by i, we deduce $(\cos A + i \sin A)(\cos B + i \sin B) = \cos(A + B) + i \sin(A + B)$; and $(\cos A + i \sin A)^n = \cos nA + i \sin nA$, where n is any positive integer. From the last result, which is called *Demoivre's Theorem*, the expansions of $\sin x$ and $\cos x$ in infinite series of ascending powers of x (see *Function*) are readily obtained.—BIBLIOGRAPHY: Elementary treatises by H. S. Carslaw, Bridgett and Hyslop, Hobson and Jessop, Levett and Davidson; for analytical trigonometry, E. W. Hobson, *Plane Trigonometry*; G. Chrystal, *Algebra*.

Trigonometry, Spherical, the branch of mathematics which investigates the relations between the sides and angles of a spherical triangle. If three lines OA, OB, OC, not all in one plane, are cut by a sphere with centre O at A, B, C, then the planes OBC, OCA, OAB will cut the sphere in three great circles. The angles between the planes of the great circles are called the *angles* of the triangle. The angle A is therefore the angle between the planes OAB, OAC, and this is obviously the same as the angle between the tangents at A to the arcs AB and AC. By the *sides* of the triangle we mean the angles subtended at O by the arcs BC, CA, AB; these are usually referred to as the sides BC, CA, AB, and denoted by a, b, c; they are proportional to the lengths of the arcs.

The fundamental relation, giving an angle in terms of the sides, may be proved as follows. Let the tangents at A to the arcs AB, AC, meet OB, OC at E, F. Then $\cos a = \cos BOC = \cos EOF = (OE^2 + OF^2 - EF^2)/(2OE.OF) = (OA^2 + AE^2 + OA^2 + AF^2 - EF^2)/(2OE.OF) = (2OA^2 + 2AF.AE \quad \cos FAE)/(2OE.OF) = (OA/OF)(OA/OE) + (AF/OF)(AE/OE) \quad \cos A$; so that $\cos a = \cos b \cos c + \sin b \sin c \cos A$. The three formulæ of this type inherently contain all possible relations between the sides and angles, as, for instance, $\sin A/\sin a = \sin B/\sin b = \sin C/\sin c$. From any formula another can be derived by changing a, b, c into $\pi - A$, $\pi - B$, $\pi - C$, and A, B, C into $\pi - a$, $\pi - b$, $\pi - c$. This is called the polar triangle transformation, the polar triangle A′B′C′ being the triangle whose vertices are the poles of the sides of ABC, with A and A′ on the same side of BC, and so on. It is easy to prove that $A' = \pi - a$, $a' = \pi - A$, &c., so that the transformation simply consists in applying a formula to the polar triangle. From the first formula given above, e.g., we deduce $\cos A = -\cos B \cos C + \sin B \sin C \cos a$.—Cf. M'Clelland and Preston, *Spherical Trigonometry*.

Tri′lobites, an extinct and widely distributed order of Palæozoic arthropods. Trilobites are especially characteristic of the Cambrian, Ordovician, and Silurian strata; a number of genera occur in the Devonian, but very few in the Carboniferous. They are named from the fact that the body is divided into three lobes, which run parallel to its axis. The number of body-segments varies greatly in different genera, and in some cases the animal could roll itself into a ball. For a long time no antennæ or limbs belonging to these animals were known, but researches undertaken in the United States have added greatly to our knowledge. The eye-lenses are frequently beautifully preserved. In *Phacops caudātus* each eye has 400 facets, and in *Asaphus tyrannus* 6000. The genera vary greatly in size, some being a few millimetres and others 50 centimetres long. See plate Palæontology.

Trimethylamine, C_3H_9N, a volatile liquid with a fishy odour, present in herring-brine and some species of flowers, usually manufactured from the vinasse of the beet-root sugar industry. It is used in the manufacture of methyl chloride, and has been used as a cure for acute rheumatism.

Trincomalee, a seaport of Ceylon, until 1905 a British naval station. It was taken from the Dutch in 1795. Pop. 11,295.

Tring, an urban district and market town of Hertfordshire, England, on the Grand Junction Canal. It is an agricultural centre. Tring Park is the seat of Lord Rothschild, who has a fine zoological museum there. Pop. (1921). 4400.

Trinidad′, the most southerly island of the British West Indies, 6 miles from the Venezuelan coast of South America. *Physiography*.—Trinidad is hilly, and has three distinct ranges trending east and west as a continuation of those of the mainland: (1) the afforested northern range (rises to 3100 feet in Tucuche), (2) a low central ridge, and (3) the southern range (also afforested). All the rivers are small, and generally flow east or west. The climate is healthy, and there are two seasons, the 'dry' (beginning of February to middle of May) and the 'wet' (May to January). The 'wet', however, has a dry break of one month (the *Indian summer*), in October. About 76° F. is the mean annual temperature. *Area, &c.*—The total area is 1976 sq. miles, and the pop. about 300,000, of which about 130,100 are Indian coolie immigrants; the white element comprises English, French, Portuguese, and Spanish, and there is a lower class of Negroes and Chinese. The chief language is English, but a peculiar French *patois* and also Spanish exist side by side with it. Roman Catholic (under an archbishop) and Anglican (under a bishop) are the chief religions. Education is either governmental and secular or denominational (State-aided), and there are State and denominational colleges. British and United States gold is current, but British bronze and silver is almost exclusively used. *Towns.*—Port of Spain is the capital and chief port. San Fernando (pop. 9000) is also a port, and Arima (5000) is inland. *Railways.*—Port of Spain is the centre. All railways are on the 4-ft.-8½-in. gauge, and the total mileage is 124. The backbone of the system is the line Port of Spain-Arima-Sangre Grande (29 miles), from which a line projects at St. Joseph for San Fernando and Siparia. At Jerningham Junction, on the Siparia line, a branch is thrown off for Rio Claro (the Caparo Valley line). The Guaracara line (10 miles) is a branch of the Siparia line running to Princes Town, which is also served by the Cipero Tramway joining the line south of San Fernando, and forming a part of the railway system. *Production.*—The exports, other than mineral, are chiefly cocoa, sugar, coco-nuts, molasses, bitters (Angostura, &c.), copra, and rum, all in order of value. There are several mud volcanoes and four mineral springs, but a great feature of Trinidad is the Pitch Lake of La Brea, 114 acres in size, which annually furnishes large quantities of asphalt. Over twenty companies are engaged in the production of petroleum, 82,396,000 gallons being produced in 1921, of which 37,802,000 gallons (49,219,226 gallons in 1919)[1] were exported. Petrol spirit and kerosene are also exported. Imports include: textiles, flour, dried fish, rice, meat, machinery, hardware, lumber, and a quantity of gold from Venezuela in transit for Europe. One-third of all trade is with the United States, a quarter with Great Britain, and one-eighth with Canada. *Government.*—Trinidad includes Tobago for administrative purposes, the colony being called Trinidad and Tobago. There is a Governor, with an Executive Council (7 members) and a Legislative Council (appointed by the Governor).

History.—Columbus discovered Trinidad (31st July, 1498), but the Spanish Governor did not take up duty until 1532. Raleigh pillaged the island, and on the whole it was a very uncomfortable place to live in until a British expedition conquered it in 1797. It became definitively British by the Treaty of Amiens (1802).

Trinidad, a Brazilian island in the South Atlantic, in 20° 30′ s. lat., 29° 50′ w. long., about 3 sq. miles in area. It is of volcanic origin and uninhabited, but has freshwater springs. About 30 miles due east are the Martin Vaz rocks (three), called after their discoverer, who landed in 1510. Trinidad was awarded to Brazil in 1895 on the grounds of its discovery in the sixteenth century by Tristan da Cunha.

Trinidad, a city of Colorado, United States, the county seat of Las Animas county, on Purgatory River; served by the Atchison, Topeka, & Santa Fé, the Colorado & Wyoming, and the Colorado & Southern Railways. It is a coal-mining centre, with coking-ovens, railway repair-shops, &c., and coal is shipped in large quantities. The adjacent region is also important for its stock-raising. Pop. 10,950.

Trinidad, a town of Santa Clara province, Cuba, about 4 miles north of Puerto Casilda (pop. 2000), its port. It has exports of sugar, rum, honey, and molasses, and coffee is produced locally. Trinidad was founded in 1514 as one of the first seven cities of Cuba, but pirates made it so unhealthy to live in that it was eventually removed inland. Pop. 40,600.

Trinity. The Trinity, in Christian usage, means the conception of God as Father, Son, and Holy Spirit, i.e. the unity of the divine nature is regarded as containing distinctions of a threefold character. The grouping of deities in a triad is not, of course, peculiar to Christianity. The sacred associations of the number three, in the ancient world, led to various trinities. Thus Hinduism had Brahma, Vishnu, and Shiva; the Egyptians had a family trio in Osiris, Isis, and Horus; and the Babylonians had triads. There were anticipations of the Christian Trinity even in Judaism, with its Alexandrian speculations about the Logos. But the Christian Trinity was not that of Father, Mother, and Son, although the mythological tendency, fostered by the later worship of the Virgin Mary, did sometimes tend in this direction, just as the original and essential Trinity "in more recent times is apt to be superseded as a practical object of devotion by the yet more human group (sometimes nicknamed the 'Jesuit Trinity') of Jesus, Mary, and Joseph, which is so vividly present to the popular religious imagination in Roman Catholic countries to-day" (C. C. J. Webb, *Problems in the Relations of God and Man*, p. 238). The Christian doctrine of the Trinity is a doctrine which seeks to interpret experience, and the primary experience is that of faith in Jesus Christ as the supreme revelation of God, as the mediator who has restored a fallen world of men to unity with God, and in whom God has united Himself with humanity. This experience has carried with it from the first an overwhelming conviction of Jesus as divine. The problem is, how to reconcile faith in one God with the passionate belief that Christians cannot give any title to Jesus which is too exalted. Along with this goes the experience of God as Spirit, not simply as the immanent soul of the world, but as present in the Church. These implications are the germs of the later speculation, which eventually became crystallized into the doctrine of the Trinity. God the Father, revealed in God the Son, through God the Spirit—that seemed the best way of expressing the full content of the Christian consciousness. The characteristic development of the 'trinity' idea in Christian theology starts from the conception of the Incarnation. Where that is grasped vitally, the Trinity becomes intelligible; not otherwise. Hence the controversies from the fourth century onwards turned first on the person of Christ, and then on the Trinity. The one truth involved the other. Which corresponds to the order of experience? The faith in the Trinity originates in the personal relationship between the Christian and his Saviour, and so far as there is a genuine Trinitarian belief it depends upon this primary experience. Through Jesus and Jesus alone we understand what the Father is and what the Spirit means. The Trinitarian doctrine may be and has been defended metaphysically and illustrated from psychology, but its soil lies in the personal religious consciousness of the Christian. "There is some real faith in the Incarnation", said Dr. Hort once (*Life of F. J. A. Hort*, vol. ii, p. 140), "left in various quarters, but in England the Trinity seems to have become the one great dogma. It has been killed, one fears, by that hapless *quicumque vult*, and its substitution of geometry for life." The evaporation of interest in the Trinity has always been due to mechanical or mythological statement of it, which have either removed it into the region of an unintelligible mystery or made it too narrow by falling into tritheistic expressions. And in both cases the failure ultimately has lain in the divorce of doctrinal speculation from experience or in an inferior type of experience.

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[1] In 1919, thirteen companies extracted 64,436,632 gallons of crude petroleum. In 1920, 72,005,947 gallons were produced, and 36,254,174 gallons exported

The term was one of those introduced by Tertullian, who was apparently the first to use *trinitas* as an expression for the distinctions within the divine nature. These distinctions are real and eternal, not passing phases of God in relation to men, as Sabellius implied. The absolute nature of God is not the result of these distinctions or eventual interactions, but their ground. The unity of God's personality involves the distinctive 'Father', 'Son', and 'Holy Spirit' as essential to the full self-expression of God. The relation of Christ as Son to the Father was not originally connected with paternity in the sense of other religions; the figures of 'Son' and 'Father' were used to denote the closest relation of being, in which one shares the life of another from whom he derives his existence and authority. Hence, when Arianism said that Jesus was merely a super-man or secondary God, the Church replied that this was neither history nor religion; Jesus was God's Son, of the same essence as the Father. Similarly, the Holy Spirit as the active power of the Godhead in the Church must be personal; this is one inference, though it has never commanded the same convincing power as in the case of belief in the Father and in the Son. In any case, the formulated doctrine does not assert three separate wills or entities in the Godhead. 'God in three persons' is more accurate than 'three persons in God'. The imperfect sense of what we know as personality, and the difficulties connected with old associations of the Greek and Latin terms *hypostasis* and *persona*, have seriously handicapped the presentation of the Trinity; even in modern times the idea of personality is apt to be confounded with individuality, and analogies are rarely helpful in explaining how one substance or essence in God is manifested in three distinct and yet interrelated modes.

The Trinitarian dogma, it is claimed, is the only one which does full justice to the implicates of the Christian experience; it completes theism by safeguarding it against deism on the one hand and pantheism on the other, but it also renders explicit the relation of the Christian to God through Christ and through the Spirit. "While the Son enables us to understand the being and action of personality within the Godhead, the Spirit enables us to conceive its being and action without. There is an immanent presence of God in man, but it represents personal agency, not impersonal energy. The God who abides in us is a person who is of the essence of the Godhead, and is ever translating its inner qualities and life into the form of one dependent yet related being" (A. M. Fairbairn, *Christ in Modern Theology*, p. 491). Thus the fullness of faith is completed. "God was in Christ reconciling the world unto Himself"; "by Him we believe in God": these instinctive expressions imply that Christ is more to us than any prophet or interpreter of God the Father. And, "because ye are sons, God hath sent forth the Spirit of His Son into your hearts, crying, Abba, Father", implies more than one influence. The Spirit completes the presence and revelation of Christ the Son. God's revelation begins by the manifestation of the Father through the Son, and is completed by the Spirit; the whole process must be equally divine, and it is the intuition of this, not any purely speculative interest, which has led to the Trinitarian doctrine.

The tendencies in modern thought which have tended to revivify interest in the Trinity, and at the same time to necessitate a restatement of its essential idea, are (*a*) mysticism; (*b*) metaphysics, with their speculations upon the absolute; and (*c*) the social interest, which points to a fullness of 'social' life in the Deity. But fundamentally the pressure in favour of the Trinitarian view comes from experience, and by its capacity to meet experience it is justified. As Dr. James Drummond admitted, in his Hibbert Lectures on *Via, Veritas, Vita* (p. 203), it has always been the "reality of the fundamental Christian facts which imparted to the doctrine all its religious vitality", and there are certain elements in the classical Christian experience, already adumbrated in the New Testament, which may be said to result necessarily in some conception of God which is trinitarian.

BIBLIOGRAPHY: The ecclesiastical history of the doctrine is treated in books like Fisher's *History of Christian Doctrine* (Edinburgh, 1896), Harnack's *History of Dogma* (English translation, London, 1894 f.), and J. Tixéront's *Histoire des dogmes* (Paris, 1902); recent discussions in T. B. Strong's *Manual of Theology* (1892, chap. iv), J. Orr's *Christian View of God and the World* (1893, chap. vii), J. R. Illingworth's *Doctrine of the Trinity* (1907), W. Adams Brown's *The Trinity and Modern Thought* (1907), S. A. M'Dowall's *Evolution and the Doctrine of the Trinity* (1918), and C. Gore's *Belief in Christ* (1922, pp. 231 f.).

Trinity College, Cambridge, was formed by Henry VIII in 1546 by the extension and consolidation of several earlier foundations. The college is the largest in the university. Of the long line of distinguished *alumni* may be mentioned Bacon, Barrow, Newton, Dryden, Cowley, Porson, Byron, Macaulay, Hallam, and Tennyson.

Trinity College, Oxford, was founded in 1554 by Sir Thomas Pope. It occupied the house and precinct of a Benedictine hall called Durham College, which was founded in 1286 and endowed by Bishop Thomas Hatfield in 1381. The front quadrangle lies open to Broad Street; there are modern buildings (1887) on the east side; on the north is the president's house and the chapel (1694) in a classic style. Among famous members of this college have been William Pitt, first Earl of Chatham; Cardinal Newman; and the historians Stubbs and Freeman. Randall Davidson, Archbishop of Canterbury, and Sir Arthur Quiller-Couch, King Edward VII professor of English literature at Cambridge, are *alumni* of Trinity College.

Trinity Hall, a college at Cambridge, founded by William Bateman, Bishop of Norwich, in 1350, incorporated by Act of Parliament in the reign of Elizabeth. 'The Hall', as it is always called colloquially, has been for many centuries famous for its teaching of law, which is encouraged by several lectureships and studentships.

Trinity House, London, a society incorporated in 1514 by Henry VIII for the promotion of commerce and navigation, by licensing and regulating pilots, and erecting and ordering lighthouses, beacons, buoys, &c. The corporation is now empowered to appoint and license pilots for the English coasts, and has a general supervision over the corporations which have charge of the lighthouses and buoys of Scotland and Ireland, subject to an appeal to the Board of Trade, to whose general superintendence the Trinity House is also subject in matters relating to England. The corporation consists of a master, deputy-master, a certain number of acting elder brethren, with an unlimited number of younger brethren. The master and honorary elder brethren are chosen on account of eminent social position, and the other members from officers of the navy or the merchant service who possess certain qualifications. The corporation derives its revenue from lighthouse and other dues. Trinity House, on the north side of Tower Hill, London, was built in 1795.—Cf. W. H. Mayo, *Trinity House, London, Past and Present.*

Trinity Sunday, the Sunday after Whitsunday. It was definitely established as a Church festival by Pope John XXII in 1334. All the principal feasts occur in the half-year between Advent Sunday and Trinity, and all the Sundays from Trinity to Advent are called Sundays after Trinity.

Trio, a composition, either vocal or instrumental, for three performers, or one written for a single instrument in three real parts. In this second case the instrument is generally the organ, and the best-known examples are Bach's six organ sonatas, in which each hand has a part, the third part being given to the pedals. In trios for three instruments the earlier examples were generally written for strings (Beethoven's five trios are excellent specimens), but with the advent of the pianoforte, combinations of that instrument with violin and 'cello came quickly into favour and have occupied the first place ever since. The best specimens are provided by the beautiful works of Beethoven, Schumann, and Brahms. The term trio is also applied to the middle, contrasting section of the typical march, or other piece of simple dance music.

Triolet, one of the fixed forms of verse invented in mediæval France; a stanza of eight lines, constructed on two rhymes, in which the first line is repeated as the fourth and seventh, and the second as the eighth. Its scheme of rhymes is therefore as follows: A, B, a, A, a, b, A, B (the capital letter represents the refrain). The triolet is the most exacting of all the fixed forms of verse, owing to its shortness and the delicate art which is required to introduce and reintroduce the refrain appositely. It is easy to write a triolet which complies with the rules; extremely difficult to write one whose art conceals its art. The triolet has been called a "tiny trill of epigrammatic melody turning upon its own innocent axis". The inventors of the triolet used it for serious poems, but it has gradually been monopolized by the most trivial and ephemeral subjects. The triolet was reintroduced into English in 1873 by the future Poet Laureate, Mr. Robert Bridges. Its most successful exponent was Austin Dobson (1840–1921). In modern France the most celebrated writer of triolets was Théodore de Banville (1823–91). The following quaint example of an early triolet was found by Austin Dobson in an old French play:

Mon fils, Absalon,
Absalon, mon fils,
Las! perdu l'avon
Mon fils Absalon;
Il faut que soyon
En grief deuil confis
Mon fils Absalon,
Absalon, mon fils!

As an English example, the following by Austin Dobson cannot be bettered:

URCEUS EXIT

I intended an Ode,
  And it turned to a Sonnet,
It began *à la mode*,
I intended an Ode;
But Rose crossed the road
  In her latest new bonnet.
I intended an Ode,
  And it turned to a Sonnet.

Triphenyl-methane, $CH(C_6H_5)_3$, a hydrocarbon in which three of the hydrogen atoms of methane (CH_4) are replaced by three phenyl (C_6H_5) groups. It may be prepared from chloroform and benzene in the presence of anhydrous aluminium chloride, and crystallizes in colourless prisms. It is the mother-substance of an extensive series of dyes.

Triple Alliance. The origin of the Triple Alliance of Germany, Austria-Hungary, and Italy, which profoundly affected international relations in Europe from 1882 to 1914, is to be traced to the settlement that followed the conclusion of the Franco-Prussian War in 1871. The annexation of Alsace-Lorraine by Germany made a future war probable, and the rulers of the new German Empire were determined to secure their position by a system of alliances. The first attempt in this direction was the League of the Three Emperors (Germany, Austria, and Russia), formed in 1871 and extended by an understanding with Italy in 1873. But the divergence of Austrian and Russian interests became acute during the troubles in the Balkans, which were terminated by the Congress of Berlin in 1878, and although the three emperors continued to meet until 1885, Germany had by that time been compelled to choose between Austria and Russia. She chose Austria, and a secret treaty was negotiated in 1879, by which the two countries agreed to support each other in the event of a Russian attack upon either. At the same time, Bismarck encouraged Italy to seize Tunis, thus embroiling that country with France; and in 1882 Italy joined Germany and Austria, and the Triple Alliance was formed. Its existence was kept a profound secret, and did not become known until it was revealed in 1887 by *The Times*. The Alliance was renewed on several occasions, and was still in force when the European War broke out in 1914. The object of Bismarck in the inclusion of Italy was to secure that France, when attacked by Germany, would be compelled to guard her Italian frontier, and, possibly, to engage in military operations there; but the event proved to be an illustration of his own saying that "international policy is a fluid element which, under certain conditions, will solidify, but, on a change of atmosphere, reverts to its original condition". Italian antagonism to France passed away, the ancient hostility to Austria reasserted itself, and some years before 1914 it was generally regarded as very doubtful if Germany and Austria could rely upon Italian support in the event of war. The renewal of the Triple Alliance was opposed in 1912 by the Nationalists in the Italian Chamber, and in the following year there was an agitation in the Italian press for its dissolution. On the outbreak of war, Italy at once announced that she did not regard herself as bound by the terms of the Alliance to give assistance to the Central Powers, and declared her neutrality; but she did not secede from the Alliance until May, 1915, when the Italian Government brought the Triple Alliance to an end by denouncing the treaty with Austria and claiming freedom of action for Italy.

Trip′oli, the name of several towns. (1) A town of Libya, capital of the Italian province of Tripolitania. It is one of the oldest cities in the world, having been founded by the Phœnicians as *Œa*, and it was chief among the three cities (Œa, Leptis Magna, and Sabrata) that formed the African Tripolis. The Roman colony *Œa Colonia* was founded in the first century, and was destroyed by the Aurusiani, a Libyan tribe, who also attacked *Leptis Magna*. After the Mahommedan conquest a new Muslim town sprang up with the old Roman name in an Arabic dialect as *Tarabulus*, which is still the

Arabic name, although *al-Gharb* (of the West) is added, to distinguish it from Tripoli in Syria. Tripoli is the Mediterranean outlet for Darfur, Lake Tchad, Kano, and Timbuktu, and is the place upon which trans-Saharan caravan routes from these places converge. It is also the nodal point of the Tripolitanian railways. Pop. 68,000. (2) A town of the Lebanon (q.v.), Syria. It was the *Tripolis* of the Phœnicians, the federal town of the three great cities of Tyre, Sidon, and Aradus, and the place where the great council of Phœnicia met on three occasions. Each of the cities had a separate walled-in quarter within the town. The Phœnician name has perished, and only the Greek form remains. In A.D. 638 the town fell to the Arabs, and thereafter figured largely in the Crusades. The modern Arabic name is *Tarabulus*. It was occupied by the British during the European War. Pop. 30,000. (3) A town of Greece, sometimes called Tripolitsa. It derives its name as representative of the site of the ancient Arcadian towns of *Tegea*, *Mantineia*, and *Pallantium*, which stood on the modern Plain of Tripoli. Tripoli itself is not an ancient foundation. Pop. 11,500.

Tripoli, a material originally brought from Tripoli and used in polishing metals, marbles, glass, &c. It is yellowish-grey or white, rough to the touch, hard in grain but not compact, and readily absorbs water. It is usually composed of the minute frustules of diatoms, accumulated in lakes; but the term is also used for similarly fine-grained siliceous material resulting as a residue from the solution of limestone. See *Rotten-stone*.

Tripolitania and Cyrenaica, two discrete districts of Northern Africa which together form the Italian colony of *Libia Italiana*, or, in English, *Libya*; area, 406,000 sq. miles; pop. about 1,000,000, of which some 28,400 are European (1923). *Physical.*—Tripolitania comprises a coastal plain of sand-dunes and *sebkhas* (salt pans in the dry and lagoons in the wet season), backed by a line of rich oases. The coastal plain is divided into eastern and western sections; the eastern dune region, fringing the Gulf of Sidra and enclosing the Sebkha Tawerga, or Great Salt Marsh, swings westward at Misurata, and draws up abruptly some 6 miles east of Homs (Khoms), where the hills reach the sea; at Homs the hills end and the western coastal plain begins. Of the oases the best known are: Mensha (or Meshia), in which stands Tripoli town; Tajura, a westward extension of Mensha; Zliten; Misurata; Zanzur; Zawia; Bu Ajila; and Zwara. Behind the coastal plain is the Jefara (sandy flats), a steppe-like region which has a breadth of 60 miles south of Zwara and narrows to 30 miles broad behind Tripoli town. These flats cover an area of approximately 5000 sq. miles, and rise in the south towards the steep crescentic escarpment of the Jebel or Main Plateau (2000 feet average altitude; Jebel Takuk, an isolated volcanic neck, 2800 feet altitude), a dissected plateau with four main divisions; (western) Jebel Nefusa; (central) Jebel Yefren and Jebel Gharian; (eastern) Jebel Tarhuna. At the foot of the mountains the intermittent rivers have brought down rich alluvial deposits, which spread on to the Jefara as delta fans. Southwards from the Jebel is The Hammada al-Homra (40,000 sq. miles), the ‘ red wilderness ’, an immense sloping plateau of red rock covered with small red stones. In The Hammada twelve years or even more may elapse between rainfalls. Bounding The Hammada on the south are the volcanic Jebel es-Suda or Black Mountains (Nabel es-Diruj, 4300 feet altitude) and their ramifications, which descend by abrupt terraces to the Fezzan basin, but rise again in the remote hinterland to merge in the main Saharan plateau. Its Saharan affinities is the chief characteristic of Fezzan[1], for it comprises only a few oases, such as Murzuq, Tejerri, and Katrun, separated from each other by rocky plateaux covered by wildernesses of sand-dunes, and broken here and there by jagged ridges. Cyrenaica is the richest region of Libya, and is physiographically the same as in the time of Strabo, despite all that has been written about desiccation.[2] It comprises a plateau, a tilted mass of Eocene limestone which, between Tolmeita and the Egyptian frontier, reaches the sea, to which it falls by two terraces, and is elsewhere separated from it by a very narrow coastal plain. Cyrenaica is a horst bounded by fault scarps. A series of powerful faults have caused the foundering of the extension of the plateau beneath the Mediterranean, and have formed the Bays of Sollum, Bomba, &c., as well as the Gulf of Sidra. According to Gregory, Cyrenaica consists essentially of a vast block of Eocene limestone capped by some outliers of Oligocene and Miocene, and fringed by low-level marine Pleistocene limestones. There are no pre-Cainozoic rocks in Cyrenaica. The plateau has western and eastern divisions, named respectively Jebel Akhdar (Green Mountains; 2500 feet) and Jebel al-Akbar (Great Mountains; 700 feet average altitude). The northern versants of these are furrowed by many deep wadis, some forming hanging valleys, and in their process of cutting back the torrential intermittent streams have carved the northern face of the plateau into hill-like formations. The Jebel Akhdar, the ancient Marmaric highlands, slope to the Nile delta, and both divisions fall southward to the Aujila depression, which separates them from the Libyan Desert, a monotonous sandy waste containing the Kufara Oasis (see *Senussi*). Along the seaboard of both Tripolitania and Cyrenaica there is a continuous drifting of sand, which has filled up many ancient harbours and has engulfed and obliterated once flourishing Roman towns such as Leptis Magna.

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[1] Fezzan actually begins at the southern end of The Hammada, and extends southwards to the Tummo Mountains, its south-western extremity touching the Tazili Plateau. One striking physical feature of Fezzan is the wadis, which depart from the uniform trend from north to south of the Tripolitanian wadis, and run from west to east. The chief wadi is the Wadi Shiati. Down to the present day the Fezzani drive their cattle to pasturage on the shores of the Gulf of Sidra, as did their ancestors when the land was the classical *Phazania*, and the gulf the *Syrtis Major*. Fezzan was the land of the *Garamantes*, but during the wars of centuries the original people disappeared, and their degenerate representatives remain in the Jebel of Tejerri and other places. At Ghat congregate the Tuareg; and the negro is ubiquitous, in fact negro blood may be said to predominate, and few of the Fezzani are free from it.

[2] Cf. J. W. Gregory, *Is the Earth Drying Up?* in *Geographical Journal*, vol. xliii (1914), pp. 148–72, 293–318 (with bibliography); also pp. 451–9.

Climate, &c.—The climate of Libya generally is Saharan, i.e. hot; but it is not unhealthy, and is made more bearable by the extreme atmospheric dryness of the three hottest months, May June, and July. Cyrenaica is drier than Tripolitania. There are two seasons, wet and cold between November and April, and hot and dry from May to October, when there is no rain, and after June all plant life except oases shrivels up and is burnt by a remorseless sun. In Tripoli the climate of Jefara and Jebel is Mediterranean, with winter rains from November to February. Snow is not uncommon at Gharian, but south of the Jebel even rain is a rarity. Malaria is most prevalent adjoining the sebkhas and oases. Other common diseases are ophthalmia (from which nearly all Arab countries suffer), leprosy, tuberculosis, and dysentery (from contaminated water, e.g. that brought down by the wadis during floods).—BIBLIOGRAPHY: (Physiographical) Dr. Adolf Vischer, *Tripoli*, in *The Geographical Journal*, vol. xxxviii (1911), pp. 487–93 (with a short bibliography); J. W. Gregory, *Cyrenaica*, in *The Geographical Journal*, vol. xlvii (1916), pp. 321–45 (with a bibliography, maps, and diagrams); H. J. Llewellyn Beadnell, *Sand Dunes of the Libyan Desert*, in *The Geographical Journal*, vol. xxxv (1910), pp. 379–95 (with plates, diagrams, and maps); J. W. Gregory, *The Geology of Cyrenaica* (*Quarterly Journal Geological Society*, part iv, vol. lxvii (Nov., 1911).

Production: Tripolitania.—In the rich oases of the coastal zone the date-palm flourishes, and provides at once the staple food, two fermented liquors, fuel and building timber, leaves for basket-making and hut-thatching, and stones for crushing as a cattle fodder or for export to the ingenious Europeans who grind them for sale under the alluring title *coffee*. Olives, oranges, lemons, and fruit trees on the coastal plain, saffron, palms, olives, and esparto grass (*halfa*; *Stipa Tenacissima*) on the Jebel, and palms around the oases, are the chief products. Salt is worked in the *sebkhas*, and the coasts of both Tripolitania and Cyrenaica are rich in sponges, which have been fished since 1885. March to October is the main season. From *Fezzan* comes soda and potash. In *Cyrenaica* salt is worked, and the date-palm flourishes on the narrow coastal plain, where, around Benghazi, the relics of the cypress and olive plantations of the ancients are still found. This coastal plain may be regarded as a transition zone in which Mediterranean and African flora meet and intermingle. In the coastal oasis horticulture is carried on. Barley is an important crop in both Cyrenaica and Tripolitania, the surplus being in good demand by Scottish maltsters for whisky production. In the hinterland there are large tracts of *halfa* as yet unexploited. Cattle, sheep, goats, donkeys (for work), horses (for riding), and camels (for food, hair, transport, &c.) are bred. According to Vischer, cattle are exported to Crete and Malta; but the main trade passes overland to Egypt. The future of Libya must be decided by agriculture alone, since of mineral wealth there is none.[1]

Railways.—In Tripolitania the nodal point is Tripoli town, whence lines run: (1) to Homs via Tajura (75 miles), with a branch at Fornaci Junction for Ain Zara (6 miles); (2) to Gharian via Azizia (81 miles), with a branch Gheran Junction-Zwara (64 miles). All these lines are on the standard Italian colonial gauge of 8 feet 1⅜ inches, and are supplemented by lines of the Decauville type. Benghazi is the nodal point of the Cyrenaican railways to Derna (a standard-gauge line). Benina and Rejma are also served by standard gauge; but Derna and Benina are centres of Decauville systems, as are also Fort Artesian and Barka.

Towns: Tripolitania. — Tripoli is the provincial capital. Other towns and settlements are: Zanzur, Zwara (port), Zawia (a district headquarters and wireless station, second only to Tripoli as an agricultural centre), Homs (a fairly modern town exporting *halfa*, and a former centre of the barley export to Great Britain), Ghargaresh (8 miles by rail west of Tripoli; a quarrying centre and wireless station), Tajura (in a coastal oasis), Misurata (a new Italian port about 7 miles east of the town; pop. 9000; a former slave-port which exports carpets, dates, and cereals, and has weaving industries), Tawerga (an oasis of 14 sq. miles on the fringe of the great Tawerga Sebkha), Soite (a port), Nalut, Mizda, Gharian (centre of an olive and barley district), Tarhuna (a district head-quarters), and Azizia (an agricultural centre). Ghadames and Ghat are trading cities and caravan centres of the hinterland. *Cyrenaica.*—Benghazi is the provincial capital. Other towns and places are: Marsa Susa (ancient *Apollonia*, port of Cyrene), Tolmeita (ancient *Ptolemais*; a modern port and garrison town), Derna (a port and railway centre; pop. 7000), Tobruk (the finest natural harbour on the North African seaboard), Sollum (on the Egyptian frontier), Merj (pop. 4000; the only Cyrenaican inland town of any consequence), and Bomba (a fine natural harbour, but inferior to Tobruk).

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[1] In classical times the rare plant *silphium* or *laserpitium*, the chief source of the gum-resin *laser*, much used by physicians of the time, was one of the chief Cyrenaican products, but the region was also famous for its ostriches and its honey, and large studs of horses were kept at Cyrene and at Barka, but especially at Barka, although there is a king of Cyrene mentioned by Pindar as a great horseman and winner of chariot-races. Silphium was, however, the staple product, and at its height Cyrene carried on a great trade in that commodity with Egypt and Greece.

Government.—Tripolitania and Cyrenaica form distinct administrative entities having each its own Governor responsible to the Italian Colonial Minister. There is a small local Parliament elected by universal franchise, and *all* natives are citizens and the political equals of those who are Italians by nationality. Tribunals and regional tribunals under civil magistrates are provided as part of the legal machinery, but in penal cases the ordinary judicial law of Italy is invoked.

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Triptych (trip′tik; Gr. *triptychos*, folded thrice), a picture, carving, or other representation in three compartments side by side; most frequently such as is used for an altar-piece. The central picture is usually complete in itself. The subsidiary designs on either side are smaller, and frequently correspond in size and shape to one half of the principal picture.

Tri′reme (Lat. *tres*, three; *remus*, oar), a galley or vessel with three benches or ranks of oars on a side, a common class of war-ship among the ancient Greeks, Romans, Carthaginians, &c. The trireme was also provided with a large square sail, which could be raised during a fair wind to relieve the rowers, but was never employed in action.

Tristan da Cunha (dȧ-kụn′yȧ), the largest of three islands in the South Atlantic (the others being Nightingale and Inaccessible Island), about 1300 miles south-west of St. Helena. In 1817 it was occupied by Great Britain, and, after the death of Napoleon, practically the whole of the St. Helena garrison and some shipwrecked mariners moved to Tristan and founded a settlement. There is no administration, no crime, and no alcohol, moral rule being in the hands of the oldest inhabitant. There are cattle, sheep, and pigs; some poultry are raised, and potatoes and fruit-trees (apple and peach) are cultivated. Food-shortage is common. Pop. about 130.

Triton′idæ, a family of marine nudibranchiate sea-slugs, many of which are found on the coasts of England, France, and other European countries.

Tritons, in Greek mythology, the name of certain sea-gods. They are variously described, but their body is always a compound of the human figure above with that of a fish below. They carry a trumpet composed of a shell, which they blow at the command of Poseidon to soothe the waves.

Tri′umph, in Roman antiquity, a magnificent procession in honour of a victorious general, and the highest military honour which he could obtain. It was granted by the senate only to one who had held the office of dictator, of consul, or of prætor, and after a decisive victory or the complete subjugation of a province. In a Roman triumph the general to whom this honour was awarded entered the city of Rome in a chariot drawn by four horses, crowned with laurel, and having a sceptre in one hand and a branch of laurel in the other. He was preceded by the senate and the magistrates, musicians, the spoils, the captives in fetters, &c., and followed by his army on foot, in marching order. The procession advanced in this order along the *Via Sacra* to the Capitol, where a bull was sacrificed to Jupiter, and the laurel wreath deposited in the lap of the god. Banquets and other entertainments concluded the solemnity. A naval triumph differed in no respect from an ordinary triumph, except that it was upon a smaller scale, and was characterized by the display of beaks of ships and other nautical trophies. The lesser triumph, which was accorded to a victorious general who had not gained a victory decisive enough to be rewarded with a triumph, was known as *ovatio*. In celebrating an ovation the general entered the city on foot, wore a robe less gorgeous than that of the *triumphator*, and had a less distinguished retinue.

Trium′vir, one of three men united in office. The triumvirs (Lat. *triumviri*) of Rome were either ordinary magistrates or officials, or else extraordinary commissioners who were frequently appointed jointly to execute any public office. But the men best known in Roman history as triumvirs were rather usurpers of power than properly constituted authorities. The term *triumvirate* is particularly applied in Roman history to two famous coalitions, the first in 59 B.C. between Cæsar, Pompey, and Crassus; the second in 43 B.C. between Antony, Octavian, and Lepidus.

Trogon (*Trogon Narina*)

Trivan'drum, a town of India, the capital of Travancore state, Madras Presidency. Pop. 63,560.

Triv'ium, the name given in the Middle Ages to the first three of the seven liberal arts—grammar, rhetoric, and logic. The other four, consisting of arithmetic, music, geometry, and astronomy, were called the *quadrivium*.

Trochu (tro-shü), Louis Jules, French general, born in 1815, died in 1896. He served in Algeria, and subsequently in the Crimean and Italian campaigns. At the outbreak of the Franco-German War (1870) he was made Governor of Paris, and when the Republic was proclaimed he was entrusted with the defence of the city, a position which he held until the capitulation. He wrote *Pour la vérité et pour la justice* (1873) and *L'Armée Française en 1879*.

Trog'lodyte (Gr. *trōglodytēs*, cave-dweller, from *trōglē*, cave, hole, and *dyein*, to creep, enter), one dwelling in a cave or underground habitation. The ancient Greeks gave the name to various races of savages inhabiting caves, especially to the cave-dwellers on the coast of the Red Sea and along the banks of the Upper Nile in Nubia and Abyssinia, the whole of this district being known by the name Troglodytikē. Archæological investigations show that cave-dwellers everywhere probably preceded house-builders. See *Cave-dwellers*.

Trogon, a genus of birds, the type of the family Trogonidæ, of the woodpecker order (Coraciiformes). Trogons inhabit the forests of the intertropical regions of both hemispheres. There are numerous species, all of them possessing most brilliantly coloured plumage. See *Quezal*.

Trollope, Anthony, English novelist, was born in 1815, and died in 1882. He came of a literary family, of which the most distinguished members were (1) his mother, Frances Trollope (1780–1863), a prolific writer, famous for her novels *The Vicar of Wrexhill* and *Widow Barnaby*, and notorious for her book on the *Domestic Manners of the Americans*; and (2) his elder brother, Thomas Adolphus Trollope (1810–92), whose innumerable novels include *La Beata* and *The Garstangs of Garstang Grange*. Anthony Trollope was educated at Winchester and at Harrow, where he had a miserable existence as a day-boy and learnt next to nothing. In 1834 he was appointed to a clerkship in the Post Office; he remained an active and efficient civil servant for thirty-three years, and introduced many new ideas into his department. He is said to have invented the pillar-box. His official duties kept him for several years in Ireland, took him all over the west of England and South Wales, and eventually carried him on trips abroad, to the West Indies and elsewhere. A life of this kind suited his temperament admirably, and provided him with abundant material for novels and books of travels. His first two novels, which dealt with Irish life, fell flat; and it was not until the publication of *The Warden* (1855) that Trollope became famous. This was the first of that series of Barsetshire novels which constitutes Trollope's chief claim to immortality. The other members of the series are: *Barchester Towers* (1857), *Doctor Thorne* (1858), *Framley Parsonage* (1861), *The Small House at Allington* (1864), and *The Last Chronicle of Barset* (1867). Amongst his other novels, upwards of sixty in number, the best known are *Orley Farm* and *The Three Clerks*. He also wrote an inadequate life of Cicero; a book on *The Commentaries of Cæsar*, in the Ancient Classics for English Readers Series; and a lukewarm life of Thackeray for the English Men of Letters Series. In his *Autobiography* (posthumously published in 1883, but written 1875–6) Trollope gave a disillusionizing account of his literary methods. He trained himself to write 250 words in a quarter of an hour, so that by working three hours a day, mainly before breakfast, he could produce a daily ration of three thousand words, and thus publish on an average three novels a year. His day, in fact, was portioned out like that of King Henry VI's homely swain:

> So many hours must I tend my flock;
> So many hours must I take my rest;
> So many hours must I contemplate;
> So many hours must I sport myself.

Trollope gained over £70,000 by his novels. He made a great tactical error in taking the public into his confidence about his methods of composition. He lost his glamour and his audience, and found himself in the position of a conjuror who has explained his tricks. It is, however, possible that there was a certain amount of irony in his insistence upon the more material aspects of authorship. He was an indefatigable civil servant, and yet he wrote that he felt "the necessity of travelling miles enough to keep his horses" (he was paid by the mileage). Trollope wrote too much and too fluently; but his best work is very good. He is not a master of his art like Fielding or Smollett; but he might not inaptly be described as a masculine and clumsy Jane Austen. He has been accused of being a realist; it has been said of him that he never creates, he only depicts, and that his books are mere transcripts from life. This is not true; he was a day-dreamer, who had a happy knack of being able to commit his dreams to paper. He said himself, "To me Barset has been a real county, and its city a real city, and the spires and towers have been before my eyes, and the voices of the people are known to my ears, and the pavements of the city ways are familiar to my footsteps". Trollope is pleasantly free from exaggeration; and two of his characters at least—Josiah Crawley and Mrs. Proudie—are fit to stand beside any characters in English fiction. He gives a most faithful picture of the society of his time.—BIBLIOGRAPHY: T. H. S. Escott, *Anthony Trollope*; G. Saintsbury, *Three Mid-Century Novelists*; Sir Leslie Stephen, *Studies of a Biographer.*

Trolls, in Northern mythology, a name of certain supernatural beings, in old Icelandic literature represented as a kind of giants, but in modern Scandinavia regarded as of diminutive size, and represented as a kind of mischievous imps or goblins.

Trombone, an instrument of the trumpet family, its tube being cylindrical and not conical, as is the case in brass instruments of the horn class. The essential feature of the trombone is the slide, by means of which the effective length of the instrument may be varied at the will of the performer. The notes of the harmonic series are alone used, and any note may be taken as a natural harmonic in one or other of the seven 'positions' of the slide. In moving from any position to the next the pitch of the instrument is altered by one semitone, and as the exact amount of movement in every case is decided entirely by the ear and experience of the performer, there is scope for great artistry in trombone playing. There is a complete chromatic range of two and a half octaves. Trombones are made in four sizes, alto, tenor, bass, and contrabass, the tenor instrument being the one most generally used. The tone of the trombone is rich and noble in quality, and the quantity is under very sensitive control.

Tromp, Martin Harpertzoon van, Dutch sailor, born at Briel in 1597, died in 1653. He went to sea with his father in 1607; received the appointment of lieutenant-admiral; gained a decisive victory over the Spanish and Portuguese fleet near Dunkirk in 1639; encountered Blake and Monk in 1653, and in the same year he again encountered Monk and was killed in the battle.

Tromsö (trom'*seu*), a northern county of Norway between Finmark and Nordland. Area, 10,420 sq. miles; pop. 90,640.

Tromsö a seaport of Norway, capital of the province of Tromsö, situated on a small island of the same name off the west coast. It has an extensive trade in fish, train-oil, &c. Pop. 7630.

Trona, a hydrous sodium carbonate, $Na_2CO_3 \cdot HNaCO_3 \cdot 2H_2O$, occurring in dry lands. Like its ally, *thermonatrite*, $Na_2CO_3 \cdot H_2O$, it is injurious to vegetation, and promotes an unfavourable clayiness in the soil.

Trondhjem (trond'hyem), a seaport-city on the west coast of Norway, the ancient capital of the country, situated on a bay at the mouth of the Nid, on the south side of the Trondhjemfiord. The adjacent island of Munkholm and the mainland have fortifications. The chief buildings are the cathedral, the finest church in Scandinavia, founded in the eleventh century over the tomb of St. Olav; and the Kongsgaard, or palace of the old Norwegian kings (now an arsenal). The trade consists chiefly in exports of timber, dried and salted fish, tar, and copper. Pop. (1920), 54,520.

Troon, a seaport of Ayrshire, Scotland. It is a favourite seaside resort for Glasgow and Kilmarnock people, and has fine sands, golf-courses, and a harbour and shipbuilding yards. Pop. 8000.

Troopial, the name common to a group of perching birds belonging to the family Icteridæ. They mostly inhabit the southern United States, but several of them appear as birds of passage in the northern states in early spring. The cow-troopial, cow-bird or cow-bunting, the blue-bird, and the bobolink or rice-bunting, belong to this group. Most of the cow-birds (Molothrus) are nest parasites, like cuckoos.

Tropæ'olum, a genus of handsome trailing or climbing plants, nat. ord. Geraniaceæ. The species are all inhabitants of South America. Some of them have pungent fruits, which are used as condiments, and others are prized for their handsome and various-coloured flowers. The principal species are *T. minus*, small Indian cress, and *T. majus*, great Indian cress. See *Nasturtium*.

Trophy, in antiquity, a monument or memorial in commemoration of some victory. It consisted of some of the arms and other spoils of the vanquished enemy, hung upon the trunk of a tree or a stone pillar by the victorious army. The custom of erecting trophies was most general among the Greeks, but it passed at length to the Romans. It was the practice also to have representations of trophies carved in stone, in bronze, or similar lasting substance. In modern times trophies have been erected in churches and other public buildings to commemorate victories, or heroic action in war.

Tropical Diseases. The community aspect of the medical sciences is nowhere more extensively and strikingly exemplified than in the study of the diseases of tropical countries. Ever-increasing numbers of the peoples of the Mediterranean basin have sought to exploit the resources of the tropics, first the Egyptians and later each rising Western empire, in the interest of their common civilization. The material advantage has been incalculable, yet it cannot be said that the white man of temperate climates has even now, after a struggle extending over thousands of years, succeeded in making a permanent home for himself and his descendants in a single region of the tropics. Solitary and the victim of disease, he returns exhausted to end his days in a temperate climate, or soon proves his vulnerability in a tropical grave. It is needless to say that this susceptibility to the tropical environment is peculiar, not extending to other races, for the most part highly pigmented in skin and hair and eyes, which an age-long process of selection or adaptation or both has endowed with exceptional powers of resistance or qualities of immunity.

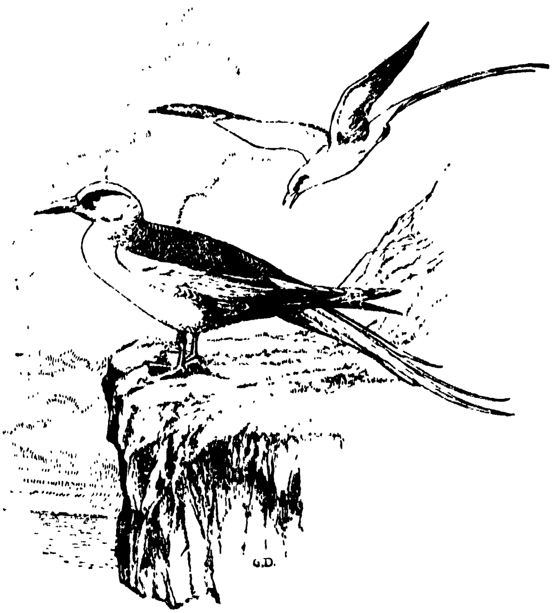
If the expression *tropical disease* is no part of a rational classification according strictly to distribution alone, it has nevertheless a singular validity in defining one of the gravest biological problems confronting civilized man. From this point of view it should not include diseases even so important as leprosy, cholera, and plague, which would thrive elsewhere were the social and sanitary conditions there equally favourable. Nor, according to Sir Patrick Manson, is there any disease, apart from traumatism, definitely attributable to the direct action of a high temperature upon the human body. The limitation of certain diseases to warm climates is with rare exceptions in no sense dependent on the action of temperature, or food, or social conditions, or the action of temperature on a disease germ while it is resident within the human body, but depends directly or indirectly on the requirements of the germ outside the body and during its passage from one human being to another. The recognition of this fact has contributed more to our ability to contend successfully with many tropical scourges than anything else; but it also awakens us to the many dangers inherent in the disseminating influences of modern means of communication. Of the generality of tropical diseases, the European is immune from none, and the native races themselves possess an immunity which is only local and specific. Modern communication and trade have unwittingly supplied over and over again the complicated conditions essential to spread. While these accidents have enormously increased our knowledge of the etiology of tropical diseases in general, and hence our power to combat them, the knowledge sometimes comes when it is too late, or in circumstances in which it cannot be applied, as in the recent extension of the area of sleeping sickness. Preserving our definition of tropical diseases as those of parasitic origin in which the parasite depends for its existence upon a high temperature during its passage from one human host to another, we find that *bacteria* are responsible for few, and that these few—Malta fever for example—have a distribution unusually limited. Fungi, protozoa, and helminth worms account for the vast majority.

Of the fungi, *Tinea imbricata* (Manson) gives rise to a tropical ringworm endemic in the Malay Peninsula and the South Sea Islands, whence it has spread to the East Indies, China, the Straits Settlements, and, more recently, Brazil. It is mainly confined to the Papuans and Malays. A pigment-bearing fungus causes *pinta*, a skin disease characterized by the appearance of variously coloured patches in the skin. It has a wide tropical distribution.

A very large number of tropical diseases are protozoan in origin, notably amœbic dysentery, malaria, with the severe form of it called jungle fever, yellow fever, and trypanosomiasis. Whereas the bacteria tend to a wide distribution, being highly resistant organisms with no climatological factor in their life-history and giving rise to diseases difficult or impossible to cure, like tuberculosis and leprosy, the protozoan parasites are distinguished by an attachment, in many cases marvellously complex, to a definite environment. Thus malaria is dependent upon the existence of infected anopheline flies, the infection of the flies upon the presence in the neighbourhood of infected natives, and the existence of the flies themselves upon the proximity of suitable breeding-pools. Trypanosomiasis, similarly, requires for its development a dual system of hosts for the parasitic *trypanosoma* in the healthy big game of the fly belt, and the tsetse fly which inoculates man. Hence arises the supreme importance of the life-history of each pathogenic protozoan. Stephens writes: "It is possible for every one who will exercise the necessary intelligence and care to escape malaria completely". If it is unhappily impossible to refer in such positive terms to all other protozoan diseases, it is nevertheless true that the prospect of a private and a public prophylaxis, based upon full knowledge and understanding of the habits of the parasite concerned, is leading to a more hopeful attitude towards the problem of tropical disease than marked the beginning of the century or even of the past decade. Moreover, if the essential interdependence of several factors in the environment of the protozoan renders the parasite biologically vulnerable, it is also individually so to a far greater extent than the resistant bacterium. Not only is quinine to all intents and purposes a specific remedy in malaria, but arsenic and antimony between them (the latter by intravenous injection of the tartrate) have now proved themselves of high value in the treatment of an ever-increasing list of tropical infections, which now includes some of those associated with the third great group of man's tropical enemies, the helminths.

Such of these as can pass from host to host in any climate, like the common intestinal worms, are cosmopolitan. Others, however, need a tropical temperature for their intermediate processes of development. In the case of *Ankylostoma duodenale*, the worm discovered by Dubini in 1838, and later called the 'tunnel worm' from its association with a deadly outbreak among the St. Gothard tunnel workers in 1880, a high temperature and the presence of moisture are both necessary for the development of the ova. There are, further, helminth worms which require intermediary hosts which, unlike those of the various tape-worms (tænia), are themselves limited to a tropical environment. Bilharziasis, filariasis (see *Elephantiasis*), dracontiasis, and distomiasis are among the diseases caused by parasites of this kind, and are true tropical diseases accordingly.

How extensive have been the researches associated with the effort in recent years to solve the problem presented by the tropical diseases is illustrated by our knowledge of the blood-sucking flies. Of mosquitoes alone over 800 have been described, but very few of these are known to be concerned in the infection of human beings, e.g. *Stegomyia fasciata*, the 'tiger-mosquito', the carrier of yellow fever, members of the genera Anopheles, Myzomyia, Pyretophorus, Myzorhynchus, Nyssorhynchus, and Cellia (malaria), and Culex, Mansonia, and Tæniorhynchus (filariasis). Important schools for the study of tropical medicine are established in London and Liverpool.



Tropic-bird (*Phaëthon æthereus*)

Bibliography: Sir R. Ross, *Memoirs, with a full account of the malaria problem and its solution*; Manson, *Tropical Diseases*; A. Castellani and A. J. Chalmers, *Tropical Medicine*.

Tropic-bird, or **Boatswain-bird**, the common name of the aquatic birds belonging to the genus Phaëthon, family Phaëthontidæ, of the stork order (Ciconiiformes), peculiar to tropical regions. There are only three species, the *P. æthereus*, *P. flavirostris*, and *P. rubricauda*. They are distinguished by two very long, slender tail-feathers. They are wonderfully powerful on the wing, being able to pass whole days in the air without needing to settle.

Tropics, in astronomy, two circles on the celestial sphere, whose distances from the equator are each equal to the obliquity of the ecliptic, or 23½° nearly. The northern one touches the ecliptic at the sign Cancer, and is thence called the *tropic of Cancer*, the southern one being for a similar reason called the *tropic of Capricorn*. The sun's annual path in the heavens is bounded by these two circles, and they are called *tropics* because when the sun, in his journey northward or southward, reaches either of them, he, as it were, *turns back*, and travels in an opposite direction in regard to north and south. Geographically the tropics are two parallels of latitude, each at the same distance from the terrestrial equator as the celestial tropics are from the celestial equator. The one north of the equator is called the tropic of Cancer, and that south of the equator the tropic of Capricorn. The word tropics is popularly applied to the region included between the two parallels.

Troppau (Czech, *Opava*), a town of Czecho-Slovakia, formerly capital of the Duchy of Silesia, Austria, on the Oppa. The manufactures consist chiefly of woollen and linen cloth, beet-sugar, beer, liquors, &c. Pop. 30,760. See *Teschen*.

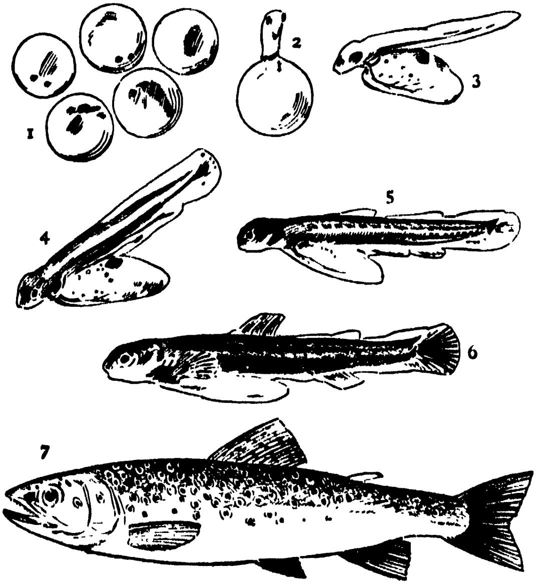
Trossachs (tros'aks), a beautifully wooded mountain pass in Perthshire, Scotland, extending for 1 mile west from Loch Achray to Loch Katrine, and situated 8 miles west of Callander. The beauty of the scenery has been immortalized by Scott in *The Lady of the Lake*.

Trotting, a sport which, in both Canada and the United States, is the chief substitute for British horse-racing. The first recorded trotting-match was run in 1818, the winner being Boston Blue, who covered the mile in 3 minutes. In 1905 Lou Dillon reduced the time to 1 minute 58½ seconds; while eight years later Uhlan achieved the record of 1 minute 54½ seconds, wind-shields, however, being employed. All 'trotters' seem to trace their pedigree to the thoroughbred English horse Messenger, imported into the States in 1788. Trotting is essentially an artificial pace, acquired by special training. The horse is run in a small two-wheeled buggy, often weighing not more than 40 lb. In England, though high-actioned trotters are exhibited at shows, the cult of 'trotting' is comparatively little followed. American trotting is controlled by the National Trotting Association, founded in 1869.

Trotzky, Lev, the assumed name of Leiba Bronstein, a Jew, Russian Communist (Extreme Left), born in the government of Kherson, 1877. Expelled from his university, he was banished to Siberia (1898–9), but escaped, and during the revolutionary phase of 1905 became vice-president of the Petrograd Soviet of Workmen. On the triumph of the Tsar, Trotzky was exiled to Siberia for life, but again escaped, and threw himself wholeheartedly into the forlorn hope of the Communist cause. The Revolution of 1917 gave him his chance, and after one abortive attempt to enter Russia, during which he was arrested by the British Government and interned at Halifax, but subsequently released on the representations of Milyukov, he reached Petrograd in May, 1917. A prominent partisan in the futile attempt to overthrow the Kerensky régime (July, 1917), he was thrown into jail, but, for some unaccountable reason, his release was almost immediate, and he triumphed after the *coup d'état* of Oct., 1917. Trotzky at this point became Minister for Foreign Affairs, and although his name is generally coupled with that of his more moderate friend Lenin as symbolical of bolshevism and anarchy, he was Lenin's most bitter opponent, and belonged to the Extreme Left party under the leadership of Bukharin. No half measures and no conciliation would suit Trotzky. Very soon the world was afforded the unique spectacle of an anti-militarist and pacifist changing his opinions; and Trotzky blossomed forth as Commander-in-Chief of the Red army. If it be remembered that he was a signatory to the humiliating Treaty of Brest-Litovsk, the situation will appear Gilbertian. In 1923 Trotzky was still the Red Commander-in-Chief, and had so modified (or sacrificed) his anti-militaristic feelings as to champion the cause of the militarization of Russian labour.

Trou'badours, mediæval poets of Southern France, who flourished between the eleventh and fourteenth centuries. They employed the *langue d'oc*, and are thus distinguished from the *trouvères*, who wrote in the *langue d'oïl*. They were called troubadours (finders), because they invented new melodies, new metrical forms, and new variations for their lyrical improvisations, which, in the end, became exceedingly artificial. The feudal and social conditions of Provence were particularly favourable to the development of the troubadours (see *Provençal Language and Literature*). The famous troubadours usually employed *joglars* (or jongleurs) to recite their poems, whilst many, who had to earn their living and depended upon the generosity of their patrons, were themselves jongleurs, accompanying themselves on the instrument. The chief patrons of the troubadours were the Counts of Provence, the Counts of Toulouse, and the Kings of Aragon and Castile, and many knights, barons, and counts were to be found among the troubadours. William IX, Count of Poitou, is supposed to have been the first troubadour. The lyrical poetry of the troubadours was essentially a court poetry, improvised for elegant and aristocratic audiences, never for the people.

In their songs the troubadours dealt with politics and war, indulged in satire, and preached crusades, but their principal theme was love. This they conceived as a sort of cult, almost a religion, love being the suzerain and all lovers his subjects. The love-songs of the troubadours were mostly addressed to married women. Their devotion was supposed to have been conventional and platonic, the lover being considered as a knight in the service of the beloved. The *genres* cultivated by the troubadours were: the *canzone*; the *sirventés*, or songs in the service of an overlord; the *planh*, or funeral song; and the *tenso*, or dispute. Of the four hundred troubadours the most eminent were: Geoffray Rudel, Bernart de Ventadour, Bertrand de Born, and Peire Cardenal. The lyric poetry of Northern France was influenced by that of the troubadours, and so were the poetry of the minnesingers, and the early middle-English lyrics.—BIBLIOGRAPHY: H. J. Chaytor, *The Troubadours of Dante*; J. F. Rowbotham, *The Troubadours and the Courts of Love*.



The Development of the Trout

1, The eggs. 2, Just hatching. 3, Just hatched. 4, Three days old. 5, Fifteen days old. 6, Five weeks old. 7, Full-grown trout.

Trout, the name of certain species of Salmo which differ from salmon in minor structural characters, such as the possession of fewer rays to the dorsal fin and more rows of scales on the tail. Only one British species, *S. trutta*, is recognized, but this includes a number of varieties or races, some of which live entirely in fresh water, while others—the so-called sea trout—only visit rivers for the purpose of spawning. Among the varieties may be mentioned: brook trout (*S. fario*); sea trout (*S. eriox*), including the sewen or western race (*S. cambricus*), and the phinock or eastern race (*S. albus*, *S. brachypoma*); estuarine trout (*S. estuarius*, &c.); great lake trout (*S. ferox*); gillaroo of Ireland (*S. stomachichus*); Loch Leven trout (S. *levenensis*); and black-finned trout (*S. nigripinnis*) of some Welsh lakes. Trout in some cases attain a maximum weight of 50 lb. The British species ranges through Europe into Persia and the northern slopes of the Himálaya, being also found in Algeria. The breeding habits of the migratory varieties resemble those of the salmon, but, unlike this, sea trout feed voraciously in fresh water. Allied species are native to Japan and the Pacific slope of North America, one of the latter being the Californian rainbow trout (*S. irideus*), which has been introduced into this country, and is recognizable by the presence of spots on the caudal fin. Trout are delicately flavoured, and afford excellent sport.

Trouvère (trō-vār; Fr. *trouver*, to find, compose), a name given to the ancient poets of Northern France, corresponding to the *troubadour* of Provence. Their productions were of a narrative or epic character, and thus contrast broadly with the lyrical, amatory, and more polished effusions of their southern rivals. The trouvères were usually men of rank and standing, knights or priests.

Trouville (trō-vēl), a seaport and favourite French bathing-place, in the department of Calvados, at the mouth of the Toucques. It is contiguous to Deauville. Pop. 6900.

Trover, in English law, an action against a man who is in possession of the goods of another, and refuses to deliver them to the owner. Strictly, an action brought by the owner of goods against a finder who has converted them to his own use, for payment of their value.

Trowbridge, an urban district and market town of Wiltshire, England, on the Biss. In the parish church there is a monument to the poet Crabbe, who was rector there from 1814 to 1832. The manufactures are chiefly in woollens; engineering and brewing are carried on. Pop. (1921), 12,133.

Troy, the most famous city in literature, the scene of the ten years' siege by the Greeks sung by Homer, was a town in the Troad in Asia Minor, 3 miles south of the Hellespont and about the same east of the Ægean Sea. Even in ancient times the site was disputed and the two-thousand-year-old controversy was only settled at the end of the nineteenth century by the researches of Schliemann (q.v.). Its site is marked by the mound of Hissarlik, originally a rocky hillock, some 50 feet high, doubled in height by the accumulated debris of successive settlements. Schliemann began his twenty years' work in 1872 by digging a great trench from the north through the debris at Hissarlik down to the solid rock. The section showed nine different strata, corresponding to nine successive occupations of the site, which, following Schliemann, it is usual to call 'cities', although the smaller were mere villages and the larger more in the nature of citadels. There was no considerable town at Troy till Roman times. The earliest settlement was proved by the remains found to belong to the neolithic period and may have existed into the beginnings of the bronze age. The second city was much more important and revealed a high degree of culture, that of a wealthy people at the zenith of the bronze age. It was occupied for a long period. The great wealth of gold ornaments found in various hoards, notably the so-called 'royal' treasure, led Schliemann to believe that this was Homer's Troy. Its buildings of clay and wood were finally destroyed by a great conflagration. The third, fourth, and fifth settlements were unimportant and bring us down to the beginning of the Mycenæan age. The sixth city with its great towers, walls, and gateways of hewn stone, at first thought to belong to about the sixth century B.C., is now known to be the Iliad's 'well-walled' Troy, although this was only established after Schliemann's death by his successor Dörpfeld, for whose work funds were provided by Schliemann's widow and the Emperor William II. The pottery found and the masonry work date it in the late Mycenæan age, about 1500–1200 B.C. It bears abundant evidence of having been destroyed by an enemy, and the latest date for its occupation agrees well with the traditional date for the fall of Troy.

The seventh city offers many problems, and has afforded interesting confirmation of the tradition of a Thracian invasion of Asia Minor. The eighth settlement brings us into historic times. It is that of an Æolian colony founded in the eighth century B.C., which led an uneventful existence till its complete destruction by the Roman general Fimbria in 89 B.C. Under the Cæsars an era of great prosperity began, for the emperors gave the new town, now called Ilion, many privileges as the home of their ancestor Æneas. With the advance of Christianity this town seems to have gradually decayed, as its associations and great temple of Athene lost their appeal, so that in course of time 'wide-wayed' Troy was forgotten, and the Turks gave a new name to the grassy mound which it became.—BIBLIOGRAPHY: Schuchhardt, *Schliemann's Excavations*; Dörpfeld, *Troja und Ilion*; W. Leaf, *Troy: a Study in Homeric Geography*.

Troy, a city of New York, United States, the county seat of Rensselaer county, on Hudson River; served by the Boston & Maine, New York Central, and Delaware & Hudson Railways. Industrially, Watervliet, Cohoes, and Waterford, on the opposite bank of the river, are practically one with Troy. Collars and cuffs and shirts are the chief manufactures. Settled in 1659, Troy was chartered as a city in 1816. Pop. (1920), 72,013.

Troy, a city of Ohio, United States, the county seat of Miami county, on the Great Miami River; served by the Cleveland, Cincinnati, Chicago & St. Louis, and other railways. It is the centre of a tobacco-growing region, and is semi-industrial, using power generated by the Miami & Erie Canal. Settled in 1807, it became a city in 1890. Pop. 10,000.

Troyes (trō-ä), a town, France, capital of the department of Aube, on the Seine; served by the Belfort line of the Eastern Railways. Manufactures chiefly consist of cottons, woollens, hosiery, soap, artificial flowers, paper, and gloves. Troyes was in existence previous to the conquest of Gaul by the Romans, by whom it was called *Augustobona*. The Treaty of Troyes between Charles VI and Henry V of England was concluded in 1420. Pop. (1921), 55,215.

Troy Weight, a weight chiefly used in weighing gold, silver, and articles of jewellery. The pound troy contains 12 ounces; each ounce is divided into 20 pennyweights, and each pennyweight into 24 grains. Hence the pound contains 5760 grains, and the ounce 480 grains. As the avoirdupois pound (the weight in general commercial use) contains 7000 grains, and the ounce 437½ grains, the troy pound is to the avoirdupois as 144 to 175, and the troy ounce to the avoirdupois as 192 to 175.

Truce, a suspension of arms by agreement of the commanders of opposing armies; a temporary cessation of hostilities, either for negotiation or other purpose. The *truce of God* was a suspension of arms which occasionally took place in the Middle Ages, and was introduced by the Church in order to mitigate the evils of private war. This truce provided that private feuds should cease at least on the holidays from Thursday evening to Sunday evening each week, during the season of Advent and Lent, and on the octaves of the great festivals.

Truck Acts, Acts passed in 1831, 1887, and 1896 prohibiting the payment of wages to workmen otherwise than in money. The Acts strike at the giving of goods as a 'reward of labour', and do not prevent the supply of materials to a workman to be used up in his work, or the making of gifts which are not in lieu of wages. The right of an employer, however, to contract with an agricultural labourer to give him food, drink (other than intoxicants), house accommodation, or other privileges in addition to money wages, as remuneration for his services, is expressly saved. Conditions imposed by an employer as to the place or manner in which his workmen shall expend their wages are void. An employer, however, is not prohibited from selling goods to his workmen for cash, provided they deal with him of their own free will and not as a condition of their employment; but if he gives credit he cannot sue for payment nor deduct the amount due from wages nor set it off against a claim for wages. By the Act of 1896, limitations are placed on the imposition of fines and deductions for negligent work. The Acts apply to all employees engaged in manual labour, except domestic servants. A person is engaged in manual labour if that is the main scope of his employment. Thus a clerk, an omnibus conductor, and a shopman engaged in selling goods, all of whom may at times have to do manual labour in the course of their duties, have been held to be outwith the scope of the Acts.

Truffle, a common name of fungi with underground tuberous fruit-bodies having a strong scent and flavour, and generally edible. The truffles so highly esteemed by epicures are species of Tuber, a genus of Ascomycetes, family Tuberineæ. They grow abundantly in the South of France (especially in the Perigord district) and in Italy, and are collected for the market with the aid of swine or specially trained dogs, which scent them out and scratch them up. Truffle-fruits are also borne by Elaphomyces and certain Gastromycetes.

Trujillo, a seaport of Honduras, on the Caribbean, a centre of the fruit trade with the United States. It was founded in 1524, and was a Spanish naval station and a place of great importance; but during the seventeenth century the ravages of pirates encompassed its downfall. Pop. 5000.

Trujillo, a city of Peru, capital of the department of Liberdad; served by rail to the port of Salaverry (10 miles). Cigars and cigarettes are manufactured. Francesco Pizarro founded Trujillo in 1535, and it was long an important place commercially. Near by are the ruins of *Grand Chimu*, one of the largest Indian cities known. Pop. 14,500.

Trujillo (Rom. *Turgalium*), a town of western Spain, in the province of Caceres, on the Tozo. Cereals, wine, and fruit are produced in the adjacent country-side; leather is manufactured. Trujillo was the birth-place of Francesco Pizarro, and a palace of his building is still extant. Pop. 12,000.

Trujillo, a state and city of Venezuela. The state is western, and has a seaboard on the Gran Lago de Maracaibo; it is traversed by the Eastern Cordillera, and bounded on the east by the Cordillera Merida. Until 1899 it was known as Los Andes. Pop. 179,000. The city is state capital, and exports coffee and cereals. It was founded in 1559, and was one of the most beautiful cities of America prior to its devastation by filibusters in 1668. Pop. 11,000.

Trumpet. The natural trumpet is confined to the notes of the harmonic series, and it is only in comparatively recent times that a reliable means has been discovered for filling up the gaps in the series, thus giving the trumpet an unbroken chromatic scale of over two octaves. This is achieved by means of three valves worked by pistons, which when depressed add to the vibrating length of the instrument by introducing into it certain pieces of tubing. The first piston lowers the pitch two semitones; the second, one semitone; and the third, three semitones. As the pistons can be used in combination, they provide a means of lowering the pitch of the natural instrument from one to six semitones. The valves thus perform the same function as the slide of a trombone (q.v.). The trumpet forms the soprano to the trombone group.

Agami or Golden-breasted Trumpeter

Trumpeter (Psophia), a genus of wading birds, family Psophidæ, of the crane order

(Gruiformes), found in tropical South America, and so named from their hollow cry. The most familiar species is the Agami or golden-breasted trumpeter (*P. crepitans*), a bird of the size of a pheasant, which is readily tamed.

Truro, an episcopal city, port, and municipal borough of Cornwall, England, at the confluence of the Kenwyn and Allen. The principal building is the new cathedral of St. Mary (the first Protestant cathedral, except St. Paul's, built in England), consecrated in 1887, Truro being established as a bishopric in 1876. It is one of the chief ecclesiastical structures of England. The city is built mainly of granite, and is engaged in the tin trade. There are tin-smelting works and potteries, and boots, clothing, and preserves are made. The harbour is dry at ebb-tide, and only vessels of 100 tons can make it. Pop. (1921), 10,833.

Trustee', in law, a person to whom property is legally committed in trust for the benefit of some other party or parties, or for some special purpose. The person for whom or in whose favour the trustee holds the estate, or any interest therein, is called the *cestui que trust* (for whom is the trust). No one is compelled to undertake a trust, but if he once accept he cannot renounce it unless the trust-deed contains a provision enabling him to do so, or, generally, if he is a gratuitous trustee, does not expressly prohibit him from doing so, or a competent court grants him a discharge, or he obtains the consent of all those beneficially interested in the estate. Trustees are liable for the consequences of any breach of trust however innocent, and the estate of a trustee deceased, who has misapplied the trust-fund, is liable for the deficiency; but generally speaking, the law only requires of a trustee the same amount of care and prudence as he would be expected to display in managing his own affairs, and the court may relieve a trustee from personal liability for any breach of trust if he has acted honestly and reasonably and ought fairly to be excused. Where there are several trustees, each is liable for his own acts and receipts only, unless where there has been common agreement and authorization. As their office is considered purely honorary, trustees are not entitled to any allowance for their trouble in connection with the trust, unless authorized by the trust-deed or agreed to by the beneficiaries. They may not invest the trust-funds on personal security, or in stock of a private company, unless specially authorized to do so by the trust-deed, but they are permitted to invest in Government stocks, stock of the Bank of England, debenture, preference, or guaranteed stock of railways, stock of municipal corporations, and generally on satisfactory real security.

Trusts, the name applied by business men and economists to all combinations of capital in industry which restrict competition. In the United States combinations of this kind originally took the form of actual trusts, all the shareholders in a number of competing firms placing their shares in the hands of a small committee of trustees, who were thus given absolute powers over the direction of the whole concern. This device, however, was declared illegal by the American courts, and has been replaced by others to which the name of trusts has clung. A Committee appointed by the British Ministry of Reconstruction in Feb., 1918, "To consider and report what action, if any, may be necessary, in view of the probable extension and development of Trade Organizations and Combinations, to safeguard the public interest", reported that "there is at the present time in every important branch of industry in the United Kingdom an increasing tendency to the formation of Trade Associations and Combinations, having for their purpose the restriction of competition and the control of prices". These associations and combinations vary very greatly in size, in form, in strength, in the extent to which they limit the freedom of the individual firms within them, and in the degree to which they constitute monopolies, with power to control output and regulate prices. The simplest form of understanding may be illustrated by the periodical meetings of coal merchants to discuss the prices to be charged by all. At the other end of the scale are such consolidations as those of Messrs. Coats, Ltd., with a capital of £10,000,000, and the United States Steel Corporation, with a capital of £369,000,000.

In Great Britain there are at the present time no statutes in force affecting combinations, beyond those provisions of the Companies Acts which enforce a measure of publicity with regard to the organization of all limited liability companies and their methods of management. Combinations operating in restraint of trade, however, though they are not criminal, are unlawful, if shown to be against public policy. In the United States and the British Dominions somewhat drastic legislation has been passed by which almost every form of trust is rendered illegal; but, in practice, these statutes have had practically no effect upon the trend of industrial development.—Bibliography: Hilton, *Memorandum on Combines and Trade Organizations*; Jenks and Clark *The Trust Problem*; Marshall, *Industry and Trade* (book viii).

Tsar, or Czar (Lat. *Cæsar*), the title of the former Emperors of Russia. It was adopted by the people in the Balkans during the Middle Ages, and was used by the Bulgarian kings. Ivan the Terrible, ruler of Moscow, was the first to be crowned Tsar (1547). Peter I assumed, however, the title Emperor (*Imperator*) (1724). The wife of the Tsar was named *Tsaritsa*, and his son the *Tsarevitsh*. See *Russia*.

Tsaritsyn, a town of Russia, on the Volga, 40 miles distant from Kalach (on the Don); served by rail from Griazi and Nikolskaya (both junctions on the great Moscow-Rostov trunk line), and to Kalach. Before the Russian Revolution Tsaritsyn was, after Nijni-Novgorod, the chief Volga port and a great transport centre, with a turnover in 1909 of 1,656,000 tons. Transhipments from river to rail and vice versa formed a large part of the everyday commercial life of the town. In addition it is a banking centre; the usual centre for timber-sales; the distributing centre for the Lower Volga-Don fisheries (stellated sturgeon, sterlet, roach, perch-pike, pike, bream, carp, lamprey, and Caspian herring, &c.); a market for tallow, oils, and animal fats; a distributing centre for wool, oil-seeds, cereals, fruit, salt, and cattle; and a storage-place for petroleum in transit from the Caspian to northern or western destinations. Pop. 100,000.

The Volga flows to the Caspian and the Don to the Black Sea. There is no canal connection between the two rivers, and a Volga-Don canal would give the former river a traffic exit to Europe and the world, instead of to an inland lake. Some high ground intervenes between the two towns, but much greater difficulties have been surmounted elsewhere. A railway line connects Tsaritsyn (direct) with Novorossiisk on the Black Sea, via Tikhoretskaya on the Vladikavkaz Railway.

Tsarskoe-Selo, or **Tsarskoye-Selo** (*Tsar's Town*), a town of Russia, in the former government of Petrograd; connected by rail with Pavlovsk and Petrograd by the earliest line constructed in Russia (1838). As the Finnish village of Saari-mois (Russ. *Sarskaya*), the site was given by Peter the Great to his wife Catherine, and the name was changed to Tsarskoe-Selo. In recent times it comprised a town and German colony, which were summer-resorts of the people of Petrograd; and the palaces and parks of the Tsars. It is now nationalized, and called Dietskoye-Selo (Children's Settlement).

Tschaikovsky, or **Tchaikovsky**, Peter Ilich, Russian composer, born in 1840 at Kamsko-Votinsk, died at Petrograd in 1893. He studied under Rubenstein at the Petrograd Conservatorium of Music. For many years he taught, first privately, and from 1866 as Professor of Harmony at Moscow, but from 1877 Tschaikovsky devoted his time entirely to composition. In 1888 he began a series of tours as conductor of his own works, making in that year his first appearance in London. In 1893 he received from Cambridge University the degree of Doctor of Music, *honoris causa*, in company with Boito, Saint-Saëns, Max Bruch, and Grieg. Tschaikovsky's great popularity may be accounted for by the sensuous quality of his music, its strong emotional appeal and wide range of expression. His symphonies and symphonic poems are among his finest works, showing his gifts as a melodist, harmonist, and master of a rich and glowing orchestration. His writings include operas, concertos, chamber music, songs, and solos for pianoforte. Among his operas are *Eugen Onegin* (1879) and *Iolanthe* (1893); his best-known symphony the *Pathétique*.

Tsetse-fly, the name of stoutly built two-winged flies native to tropical Africa, and belonging to the genus Glossina. Some of them cause fatal diseases in man and various mammals by introducing protozoan parasites (trypanosomes) into the blood. *G. palpalis* and *G. morsitans*, for example, are responsible for nagana or fly-disease in horses, cattle, camels, buffaloes and antelopes, the parasites being *Trypanosoma brucei* and *T. congolense*. Sleeping sickness in human beings is set up by *T. gambiense*, disseminated by *Glossina palpalis*.

Tsingtao, the port and administrative centre of Kiaochow (q.v.), China. On 10th Dec., 1922, the Chinese flag was raised over the administration building for the first time in twenty-four years, and Wang Cheng-ting, the Chinese Foreign Minister, accepted the territory of Kiaochow from the Japanese.

Tsu, a town of Honshu, Japan, on Ise Bay; served by rail to Kyoto. It has manufactures of textiles and fancy wares. Pop. 46,000.

Tsumeb, a railway terminal station of the South-West Africa Protectorate, 356½ miles from Swakopmund. With Otavi and Grootfontein it forms the richest copper-producing centre of the Protectorate, the output being as follows:

Period.	Copper and Lead Ores.	Copper Matte.	Metallic Lead.
	Tons.	Tons.	Tons.
1907–12	139,200	10,301	9,385
1912–13	44,550	656	400
1913–14	50,070	1,180	—

Tsuruga, a seaport-town of Honshu, Japan, on an arm of Nakasa Bay; served by rail to Kyoto. It has manufactures of textiles, and has regular steamship connection with ports of the Far Eastern Republic. There are shipbuilding-yards. Pop. 20,000.

Tsushima, a Japanese island lying between Korea and Iki (island), about 50 miles from the Korean coast. Izuhara is the chief town. During the Russo-Japanese War a great naval engagement was fought on 27th and 28th May, 1905, in which the Japanese under Togo outmanœuvred and decisively defeated an equal number of Russian capital ships (12) under

Rohzdestvensky. This battle is called Tsushima. Area of island, 260 sq. miles; pop. 40,000.

Tuam, an episcopal city of Galway, Ireland. It is the seat of the Protestant Bishop of Tuam, and also of the Roman Catholic archbishop. Its principal edifices are the Protestant and Roman Catholic cathedrals, the episcopal palaces, and the college of St. Jarlath. Pop. 6000.

Tuapse, a Ciscaucasian port on the Black Sea; a terminal of the Armavir-Tuapse Railway, which starts from Armavir Junction on the Vladikavkaz Railway and runs through the Maikop oil-fields. It was opened in 1914, and completed in 1916. Tuapse roadstead is protected by two moles, and a safe harbour was completed about 1915. Pop. 20,000.

Tuareg, or **Tawarek**, the autochthonous Berber (Hamitic) peoples of the West-Central Sahara who were supplanted by Arab (Semitic) conquerors of North Africa during the eleventh century, and adopted thereafter a nomadic life. Among themselves they are known as *Imoshagh*, and their language as *Tamashek*, the purest dialectical survival of the ancient Berber tongue. The Tuareg occupy over 1,000,000 sq. miles of territory, and number (at a guess) 400,000 souls. There are four main tribes: (1) the Azjer of Ghadames and Ghat; (2) the Kelui of Air; (3) the Ahaggar tribe; and (4) the Awelliminden of the Timbuktu region. The Malekite sect of Sunnite Mahommedanism is nominally the chief religious denomination. To the Arabs the Tuareg are ' the Veiled People ', from their *litham* or veil, which in the case of nobles is blue, white being the colour of the *Imghad* (hereditary serfs) and the slaves. The *litham* acts as a protection against wind-blown sand, but in course of time it has acquired a religious significance, and is never removed in public. From the two colours the terms ' black ' and ' white ' Tuareg are derived.

Tuberculosis, an infective disease caused by the *bacillus tuberculosis*, an organism a little more than three-thousandths of a millimetre (3·5μ) long, demonstrated by Koch in 1882. The typical reaction to which the bacilli give rise is a chronic inflammation characterized by the development of the nodular *tubercles*, which give the disease its name. Such nodules are in reality minute battle-grounds between the infective organism and the surrounding body tissue, which, owing to the often inadequate reaction of that tissue, tend to increase in size, to coalesce, and later to undergo secondary changes, the formation of areas of dead tissue, caseous in character, and subsequent softening, calcification, or change into fibrous material. Infection may take place by hereditary transmission, exceedingly rare in man; by inoculation, which occurs occasionally among pathologists, other medical workers, and among butchers; by inhalation, which must be less frequently a source of infection than is commonly supposed; and by ingestion. Von Behring has gone so far as to assert that adult phthisis is always due to infection through the intestinal wall early in life; but this view is extreme. From the skin to the brain there is no tissue of the human body exempt from infection by the bacillus, the commoner sites being the lung, bones, and joints, notably the hip-joint and the spine, the intestine and the lining membrane of the abdomen, the membranes of the brain, the kidney, and urinary bladder, and the lymphatic glands of the neck. Tuberculosis, the most widely distributed of the diseases fatal to man, is responsible for one in ten of all deaths in Great Britain. Cures increase in number with the advance of medical science, and to an even greater extent prevention steadily decreases the mortality. Sunlight and proper feeding are still, in spite of bacteriological advances, the most effective means of combating the disease. See *Consumption*.

Tuberose (*Polianthes tuberōsa*), a plant of the nat. ord. Liliaceæ, originally brought from the East, and now largely cultivated under glass in Europe both for its perfume and for its beautiful white flowers. It has a bulbous root, and an upright branchless stem growing to the height of 3 or 4 feet. It is cultivated for the perfumers in France and Italy.

Tübingen (tü′bing-in) a town of Württemberg, Germany, on the Neckar. Manufactures include chemicals. The university was founded in 1477, and has a library of over 800,000 vols. Reuchlin and Melanchthon were professors there, as was also F. C. Baur (founder of the Tübingen school of theology) (q.v.). Tübingen is a junction on the Plochlingen-Villingen line for Sigmaringen and Herrenberg (pop. 8000). Pop. (1919), 20,480.

Tubip′ora, a genus of corals belonging to the sub-class Alcyonaria, and represented by the familiar scarlet organ-pipe coral (*T. musica*), and by other species.

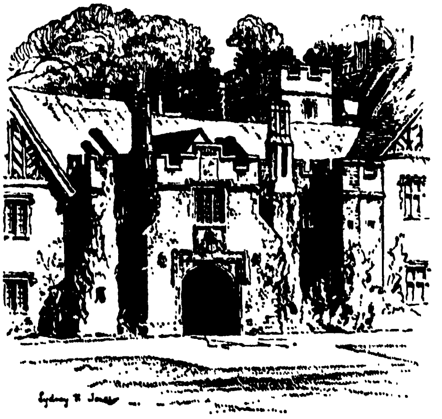
Tubuai Islands, a French atoll group in the Pacific Ocean, south of the Society Islands. Copra, bananas, arrow-root, and some sponges are produced. Pop. 1000.

Tucson, a city of Arizona, United States, the county seat of Pima county, on Santa Cruz River; served by the Southern Pacific Railway. It is an educational centre, and has the University of Arizona. There are railway head-quarters (divisional) and repair-shops, and the city is the centre of a rich irrigated agricultural region. The winter climate is mild and attracts many visitors. Tucson was taken over by the United States in 1856, and became a city in 1883. Pop. 20,300.

Tucumán′, a north-central province of Argentina. It falls from the Sierra de Aconquija in the west to a rich flat plain in the east, and is drained by the Dulce (Sali) and its many affluents. The valleys of the Sierra are afforested and much worked for timber; the latter produce cereals and fruit. Cattle are raised; leather, hides, skins, sugar, cheese, and *aguardiente* (a distilled alcoholic beverage resembling brandy) are exported. Tucumán is the capital. Area, 10,422 sq. miles; pop. 350,690 (the smallest and most densely populated province of Argentina).

Tucumán, or **San Miguel de Tucumán**, a city of Argentina, capital of the province of Tucumán, on the Dulce (Sali); a prominent railway junction. Alcohol, beer, and sugar are made; the environs have numerous orange-groves and sugar-plantations, which flourish in a mean annual temperature of 68° F. (approximately). Agues and fevers of malarial type are fairly prevalent. Tucumán was founded by Villaruel in 1564, and supplanted Santiago del Estero in 1680 as capital of the Spanish province of Tucumán. The conference which proclaimed the independence of the La Plata provinces met at Tucumán in 1816. Pop. 92,000.

Tudela (Rom. *Tutela*), a city of Spain, in the province of Navarre, on the Ebro; served by the Saragossa-Alsasua Railway, and by a line to Tarazona (ancient *Turiaso*, the seat of a bishop; pop. 9000). Sawmilling, and the manufacture of cloth, liquor, dried fruit, &c., are the chief occupations. Tudela was in Moorish hands for over three centuries before its surrender in 1114 to Alfonso I of Aragon. Pop. 9500.



Tudor Style. Compton Wyniates, Warwickshire, 1525

Tudor Style, in architecture, a name frequently applied to the latest Gothic style in England, being the last phase of the perpendicular, and sometimes known as *Florid Gothic*. The period of this style is from 1400 to 1537; but the term is sometimes extended so as to include the Elizabethan period also, which brings it down to 1603. It is the result of a combination of the Italian style with the Gothic. It is characterized by a flat arch, shallow mouldings, and a profusion of panelling on the walls.

Tuesday, the third day of our week, so called from the Anglo-Saxon god of war, *Tiw*. It was called *Dies Martis* (day of Mars) by the Romans, whence the French *mardi*.

Tugela (tụ-ga′la), a river of Natal, rising in the Drakensberg Mountains, and flowing to the Indian Ocean 50 miles north of Durban; length, 300 miles. Several places on or near it, notably Colenso, came into prominence during the South African War.

Tuileries (twēl-rēz; from Fr. *tuile*, a tile, because the spot on which it was built was formerly used for the manufacture of tiles), a former royal palace in Paris, on the right bank of the Seine. Catherine de' Medici, wife of Henry II, began the building (1564); Henry IV extended it, and founded the old gallery (1600), and Louis XIV enlarged it (1654), and completed that gallery. The side towards the Louvre consisted of five pavilions and four ranges of buildings; the other side had only three pavilions. Napoleon I resided in the pavilion of Flora, as did afterwards Louis XVIII and his successors. During the Revolution of 1830 the palace was sacked. It was restored by Louis Philippe to its former splendour, but in 1848 it was again pillaged. The Tuileries then became a hospital for wounded, a picture-gallery, and the home of Louis Napoleon in 1851. On 23rd May, 1871, it was almost totally destroyed by fire (the work of the communards), and the remaining portions were removed in the year 1883.

Tula, a former government of Central Russia; area, 11,960 sq. miles. The surface is generally flat, and the principal rivers are the Oka, the Upa, and the Don. Much grain is produced, and vast numbers of horses, cattle, and sheep are reared. Iron is smelted and manufactured to a large extent. Pop. 1,830,000.

Tula, a town of Russia, capital of the former government of Tula, on the Upa; served by rail from Moscow. It is semi-industrial, manufacturing rifles mainly, but also cutlery, soap, candles, cordage, leather, and tea-infusing urns (*samovars*). Pop. 136,530.

Tulcea, a town and port of Roumania, in the Dobruja, capital of the department of Tulcea, on the St. George arm of the Danube; the northern terminal of the trans-Dobrujan Railway to Dobrici, via Babadag and Megidia. It is an important fish-market, with a bank and a grain trade. Pop. 23,000. The department is one of the best agricultural regions of the Dobruja. It lies outside of the Danube delta, and includes the oak- and beech-wooded hills and the many streams of the Babadag Plateau. Copper and copper pyrites are found, and hematite iron is said to exist. Area of department, 3330 sq. miles; pop. about 190,000.

Tulip, a genus of plants (Tulĭpa), nat. ord. Liliaceæ. The species are bulbous herbaceous plants, inhabiting the warmer parts of Europe and Asia Minor, and are now extensively cultivated in gardens. About forty species have been described, of which the most noted is the common garden tulip (*T. gesneriana*), a native of the Levant, and introduced into England about 1577. Upwards of 1000 varieties of this plant have been enumerated. The wild tulip (*T. sylvestris*), a doubtful native of Britain, has yellow flowers, and blooms in April and May. The sweet-scented tulip (*T. suaveŏlens*) is much prized for its fragrance. About the middle of the seventeenth century an extraordinary tulip mania prevailed in Holland. Enormous sums were given for bulbs, the ownership of a bulb being often divided into shares, in which men speculated as they do in ordinary stocks or shares.

Tulip Tree, an American tree bearing flowers resembling the tulip, the *Liriodendron tulipifera*, nat. ord. Magnoliaceæ. It is one of the most magnificent of the forest trees in the temperate parts of North America. Throughout the United States it is generally known by the name of poplar, white wood, or canoe-wood. The wood is light, compact, and fine-grained, and is employed for various useful purposes.

Tullamore, an urban district and market town of King's County, Leinster, Ireland, the county town, on the Clodiagh River. There are two breweries, a large distillery, aerated mineral-water works, &c. Pop. 4600.

Tulle (tül), a city of France, capital of the department of Corrèze, on the Corrèze. It has a cathedral and episcopal palace, a communal college, a diocesan seminary, &c., and manufactures fire-arms (a State industry), drugget, wax-candles, playing-cards, leather, &c. It is on the Brive-Ussel and Uzerche-Argentat railways. Pop. 16,942.

Tulloch, John, Scottish theologian, born 1823, died 1886. Educated at St. Andrews and Edinburgh Universities, he was appointed (1854) principal of St. Mary's College, St. Andrews, a position which he held until his death. Tulloch was an influential leader in the councils of the Scottish Church, and the author of the Burnet prize essay on *Theism* (1855), *Pascal* (1878), *Facts of Religion and Life* (1877), besides many articles in the reviews. He had a share in founding *The Contemporary Review*, and was the last editor of *Fraser's Magazine*.

Tullus Hostilius, according to the legend, third King of Rome and successor to Numa Pompilius (670–638 B.C.), a warlike monarch, in whose reign took place the combat of the Horatii and Curiatii.

Tulsa, a city of Oklahoma, United States, the county seat of Tulsa county, on the Arkansas River; served by the Atchison, Topeka, & Santa Fé, and other railways. Natural gas is found in the vicinity, and is used for power; glass and cotton-seed oil are made. Settled in 1887, Tulsa became a city in 1902. Pop. 72,100 (the second largest city in the state).

Tumbes, the northernmost province of Peru, South America, contiguous to Ecuador. Tumbes, a port on a river of the same name, is the capital (pop. 6000), and is the place where Pizarro landed in 1527. Area (province), 1980 sq. miles; pop. 10,000.

Tummel, a river of Perthshire, Scotland, rising from Loch Rannoch, and forming Loch Tummel about half-way to its confluence with the Tay below Logierait. In its valley is found the most picturesque of Scottish scenery; length, 40 miles.

There is a complete system traceable from Stob Ghablar (3565 feet altitude), where the river rises as the Bà, expands into Loch Bà, and empties into Loch Laidon by the Abhainn Bà. Laidon is emptied by the Gearr Ghaoir into Loch Eigheach, whence the waters are carried to Loch Rannoch by the Abhain Gaoire.

Tumour, in surgery, in its widest sense, a morbid enlargement or swelling of any part of the body or of any kind; more strictly, however, it implies a permanent swelling occasioned by a new growth, and not a mere enlargement of a natural part, which is called hypertrophy. Tumours may be divided into two well-defined classes: (*a*) *Simple, benign*, or *innocent tumours*, the substance of which has anatomical resemblance to some tissues of the body; they gradually increase in size, and generally only produce inconvenience from the great bulk they sometimes attain; a complete cure may be effected by simple excision. (*b*) *Malignant tumours*, which bear no resemblance in substance to normal tissue; they are exceedingly liable to ulceration, they invade all the textures of the part in which they occur, affect the mass of the blood, and may terminate fatally; when excised they are apt to recur not only in the immediate neighbourhood of the previous site, but also in remote parts of the body. Of the malignant class cancer is a well-known example. See *Cancer*.

Tunbridge Wells, Royal, a municipal borough and watering-place of Kent, England. Incorporated in 1889, it has been called Royal since 1909. It has a spacious parade, Pump Room for visitors taking the waters, and Convalescent Home for Children. Manufactures include toys and fancy articles. It is one of England's most fashionable inland spas, and is much frequented in August and September. The chalybeate springs were discovered in 1606. Pop. (1921), 35,568.

Tundras, a term applied by physical geographers to the immense stretches of flat, treeless country extending along the arctic coastal regions of Eurasia and America. They are frozen the greater part of the year, but in summer thaw out into vast mosquito-infested prairies and swamps. The inhabitants are Samoyeds, Ostyaks, Yakuts, Finns and Lapps (all Eurasia), and Eskimos and Indians (North America).

Tungsten, a metal discovered in 1781; atomic weight, 184; symbol, W (from its other name *wolfram*). It has a greyish-white colour and considerable lustre. It is nearly as hard as steel, and less fusible than manganese. The ores of this metal are the native tungstate of lime and the tungstate of iron and manganese, also known by the name of *wolfram*. By suitable operations the metal may be drawn into wire, which is largely used in the manufacture of electric-light bulbs (see *Electric Light*). Tungsten is also much used in the manufacture of self-hardening and high-speed tool steels.

Tungurahua, or **Tunguragua**, a central province and mountain of Ecuador, South America. The province comprises the Ambato basin (average, 8000 feet altitude), one of the three plains into which the high plateau (300 miles long) between the two Cordilleras is divided. This is largely an arid waste; but the eastern slopes of the Cordillera Occidental are also within the province, which is named after the quiescent volcano Tungurahua (16,690 feet), famous for its cataract and lava stream. At the foot of Tungurahua are the thermal springs of Baños (5900 feet altitude). On the western border lie Chimborazo and Carahuairazo (16,515 feet). The latter is known in Ecuador as Chimborazo's Wife. Ambato (altitude, 8435 feet; pop. 12,000), the capital, is on the railway to Curaray (182 kilometres), via Pelileo (34 kilometres). Area of province, 1685 sq. miles; pop. 103,000.

Tungus, a Turanian people occupying a vast territory of Eastern Asia (see map under *Turanian*). They are nomads and huntsmen, and number about 76,000. Apart from the Tungus proper, the Manchus of Manchuria form the principal division of the Tungus generally, and they number in round figures 1,000,000 souls. There are no Tungus towns and no houses, tents only being used. Shamanism is the chief religion, although there is, here and there, a thin veneer of Christianity, and Buddhism has, through Chinese influence, become prevalent among the southern groups. Physically, the Tungus are Mongolian and of low stature (about 5 feet 4 inches). The Tungus language forms a branch of the Turanian or Ural-Altaic family, and among its dialects Manchu is outstanding, for the Manchus are not only the chief Tungus people, they also form the only division with a history. Their dialect is still characterized by the Turanian vowel harmony; and, with the passing of the ages, as the language of the former ruling caste of China it has developed a considerable literature.

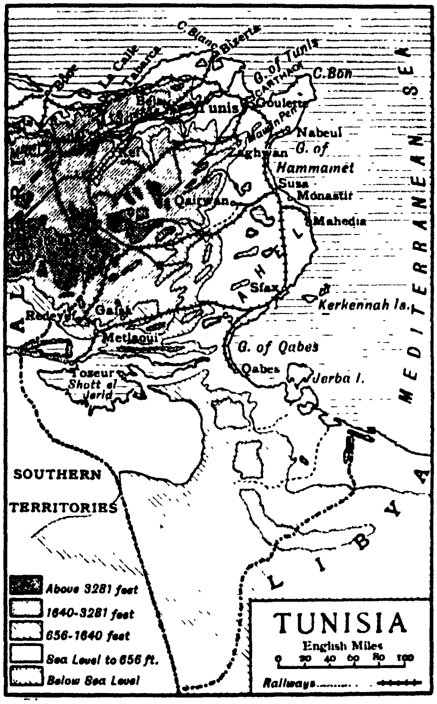
Tunica'ta, a class of animals constituting the degenerate sub-phylum Urochorda of vertebrates. A simple tunicate is enveloped in a leathery mantle, with two orifices, one oral and the other anal, and covering the body-wall, to which it adheres at the orifices. These animals are popularly named *sea-squirts*, and are found either solitary or in groups, fixed or floating. See *Ascidia.*

Tunis, the capital of the French protectorate of the Regency of Tunisia. It stands on a narrow isthmus which separates the salt lake Sebkha es-Sedjoumi from El-Bahira, or the Lake of Tunis, and is connected with the Bay of Tunis and the Mediterranean by a ship-canal opened in 1893. There is a native town, a typical Arab city with attractive *suqs* (bazaars); but the administrative and other European offices and businesses are located in the Quartier Franc, a new French city fringing the shores of the Bahira. Pop. 170,400, of whom 79,200 are Muslims, 42,600 Italians, 22,200 French, 19,000 Jews, and 7400 Maltese. See *Tunisia* (*Climate* section).

The ship-canal, some 7 miles in length, made Tunis a seaport, and practically terminated the prosperity of Goletta, which up to 1893 had been its port. Goletta is built on the storm beach which encloses the Bahira, and is at the seaward end of the canal, along the right bank of which it is connected by tramway with Tunis. There is still at Goletta a large dock, about 1000 feet long by 500 feet in breadth, which is connected with the canal by the Goletta (Ar. *Halk el-Wad*, throat of the river, i.e. gullet, of which an obsolete English variant is *golette*). The French name is La Goulette. Goletta is quite near the ruins, majestic even in decay, which mark the site of ancient Carthage. There is a fort and battery and an arsenal. Pop. of Goletta, about 6000. North of the town, about 5 miles distant, is El-Marsa, a sea-bathing resort and villa-town.

Tunisia, a regency of North Africa, extending along the Gulf of Qabes (Gabès; ancient *Syrtis Minor*) and the Mediterranean, and forming a protectorate of France. The name of the country in Arabic is *Ifriqiyah*, an archaic Berber form of which (*Ifrigia*) was latinized as *Africa* by the Romans; and so Tunisia of to-day was the original Africa of classical times, and from the designation of a puny state the name rapidly extended, replaced that of *Libya*, and became the customary title of the entire continent. Modern Tunisia is bounded by Algeria, the Sahara, Tripolitania, and the Mediterranean, and occupies an area of about 50,000 sq. miles, with a pop. (1921) of 1,937,824 non-Europeans, and 156,115 Europeans. The majority of the native Arabic-speaking population are Muslim Berbers, who number (1921) 1,889,388, the remainder (48,436) being Jews. Among Europeans are 54,476 French, 84,799 Italians, and 13,520 Maltese.

Physical.—Tunisia consists of four distinct physical regions, namely, Tell, Sahel, Central Plateau, and Sahara. The Tell is a mountainous, wooded, and well-watered continuation of the Algerian Tell, tucked away in the north-west corner of the protectorate. The heights are interposed between the sea and the valley of the Majerda, the only large perennial stream in Tunisia. It is the *Magarath* of the Carthaginians and the *Bagradas* of the Romans, and has its main source in the Majerda Mountains (Monts de la Mejerda) in Algeria, falling into the sea on the north coast after a course of 300 miles. The drainage area is 10,000 sq. miles. It is a notable fact that, in the course of centuries, the deltaic fan of the Majerda has extended to fill up the ancient lagoon of Utica, upon which at one time stood the majestic Tyrian city of Utica (q.v.). The Sahel region is the coastal plain, varying between 30 and 60 miles broad, which extends in a northerly direction from the *Jefara* of Tripolitania to Cape Bon (*Ras Addar*; ancient *Hermæum Promontorium*). In Algeria the Atlas [1] becomes a wide central plateau, and this extends into Tunisia between the Majerda Valley on the north and the Sahara region on the south, with an average altitude of 2000 feet. It is arid in parts. The Tunisian Sahara occupies the whole of the south, and is traversed by the so-called Matmata Plateau, a dissected table-land rich in vegetation and rising to an average altitude of 3000 feet.



Climate.—Tunisia is normally healthy, but climatic conditions are variable. In the Sahara rain may not fall for years, but the Tell, which has developed as a health-resort, has a good rainfall all the year round. On the Sahel there are two seasons, winter and summer, winter being the wet season and summer the dry. The former lasts from November to March, when the prevailing winds are from the north-west or north-east. Summer occupies the rest of the year. In Tunis (141 feet altitude) the mean annual temperature is 64·2° F. (January, 49·6°; August, 79·9°; range, 30·3°); and the mean annual rainfall is 17·9 inches.

Towns.— Tunis is the capital; Susa (Fr. *Sousse*), Sfax, and Qairwan (Kairwan) are important, and Bizerta is a naval dockyard and depôt rivalling Gibraltar or Malta. Others are Monastir, Béja, and Gafsa.

Production: Agricultural.—Tunisia is mainly a cereal-raising country, producing fine wheat in relatively large quantities. Especially fertile corn-growing plains extend from below Mejez el-Bâb, and the uplands also are suitable for cereals. From the Sahel come olives, and the trade in olive-oil becomes yearly more important. Mediterranean fruits thrive in the Tell, and in the hinterland graze the big-tailed (Udad or Barbary) sheep and black goats. The breeding of cattle, horses, and camels is especially fostered by the French. *Halfa* [2] or esparto is prolific in the Central Plateau. *Forestry.*—In the past there was an indiscriminate destruction of trees, and this the French administrators had to put down at the same time as they attempted the re-afforestation ot large areas. Cork and olive trees are indigenous; alder and poplar are common; and the Aleppo pine is found in the Central Plateau. *Fisheries.*—There are valuable tunny-fisheries, and dredged coral is of importance, as are also the rich sponge-fisheries in the Gulf of Qabes. *Minerals.*—Perhaps the greatest potential wealth of Tunisia lies in its enormous phosphate deposits, but large quantities of iron and zinc have also been worked. A peculiar feature of Tunisia is the large number of its hot mineral and other springs. Where these springs are of fresh water and hot, they are usually harnessed for the irrigation of the oases, and the *sebkhas* dry up for want of their water. Medicinal springs exist at Korbus and at Hammam Lif and Gafsa. *Commercial.*—Tunisian exports are mainly cereals, wines, olive-oil, fruit, vegetables, phosphates, metal ores, *halfa* (esparto), and hides; and her imports are (generally speaking) manufactured goods of all kinds, coal and fuels, agricultural machinery and implements, textiles, and food-stuffs that she does not herself produce. In 1921, 50·93 per cent of the imports were from France, and 41·72 per cent of the exports went to France. Great Britain's share amounted to 9·50 per cent of the imports, and 9·65 per cent of the exports, the imports being mainly coal, cotton fabrics, and machinery.

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[1] See physical section of *Morocco*. Tunisia has about 200 miles of the Atlas system which is clearly a physical entity although not one single and complete mountain range. For the whole of its length from Morocco to the Gulf of Qabes the Atlas is backed by a depression separating the mountains from the vast Ethiopian Plateau, just as the Indo-Gangetic plain or depression separates the Himálaya from the high plateau of the Indian Peninsula. In Tunisia the Shott el-Jerid (some 60 feet altitude) and other *sebkhas* (all below sea-level) occupy the depression. Sir Harry Johnston has pointed out that the *Shotts* of the French is a misnomer for Ar. *Shat*, an estuary or lake. An estuary or arm of the sea unquestionably occupied this *sebkha* region recently in geological time, unless it is due to volcanic action, but now there remain only mud-flats, which in the dry season are hard-caked and coated with a deposit of salt.

[2] *Halfa* is the Arabic form of English Alfa, i.e., *Stipa Tenacissima*, or esparto grass (q.v.).

Government.—A French Resident-General is the real administrator of Tunisia, although the Bey of Tunis is still nominally the ruler. The office of Bey is hereditary in the Cretan House of Hussein ben Ali, whose descendants have ruled since 1705. There is a mixed Ministry, comprising 3 Tunisian and 8 French departmental chiefs, and the Government is supported by an army of about 26,200, all ranks. The coinage is similar to that of France, and the metric system of weights and measures is prevalent. Tunisia was in the heart of the Carthaginian possessions, and after the fall of Carthage became part of the Roman province of Africa. On the fall of the Roman power, there was a period of Vandal domination (A.D. 430–533), then the conquest by Belisarius and over a century (533–647) of Byzantine misgovernment prior to the overwhelming advance of the Arabs. After the fall of the Fatimid dynasty and a period of anarchy, the Ottoman domination began (about 1575). In 1881 France declared a protectorate over Tunisia, and the power of the bey is only nominal.

Railways.—The Tunisian system has three nodal points, Tunis, Susa, and Sfax. The backbone of the system is the Tunis-Sfax line (176 miles), via Hammam Lif, Fuduk Jedid (18 miles; branch for Henshir Lebna, 30 miles), Bir bu Rebka (37 miles; branch for Nabeul), Enfidaville, Susa (93 miles), and El Jem. Tunis is connected with the Algerian system by a line reaching the frontier at Ghardimaou (117 miles), via Mejez el Bâb, Mastouta (branch to Béja, 9 miles), and Souk-el-Arba; and continued to Bône, 220¼ miles from Tunis. Other lines from the capital connect with Bizerta (61 miles, via Mateur; branch to Béja, 42 miles); and with Kalaat Jerda, via Depienne (for Zaghwan), Pont du Fahs, Gaffour, Les Salines (for Le Kef), and Wed Sarrath (for the Algerian frontier at Kalaat es Salaam, 18¾ miles). The latter is more or less a phosphate railway. Hammam Lif is a popular Tunisian seaside-resort with thermal springs, and has special train service from the capital, 10 miles distant. Other main lines are: (1) Susa-Moknin-Mahedia, a short coastal line of 39 miles; (2) Susa-Kalâa Srira-Ain Ghrasesia (30 miles; for Qairwan), Sbeitla, Feriana, and Henshir Suatir, about 184 miles in all; and (3) Sfax-Redeyef, 177 miles, via Graiba (39 miles; for Qabes, 51 miles), Gafsa, and Metlaoui (151 miles; for Tozeur, 33 miles).—BIBLIOGRAPHY: Sir Harry Johnston, *The Colonization of Africa*; Douglas Sladen, *Carthage and Tunis*; Hesse-Wartegg, *Tunis: the Land and the People.*

Tunnel, a subterranean passage, cut through a hill or under a river. The processes used in construction vary considerably. In one method a shield is used. This consists of a cylindrical steel shell with a cutting edge which is pressed into the head of the tunnel which is to be excavated. As the material is removed the whole shield is pressed forward by hydraulic jacks or rams. Steering to keep to the desired line and level is effected by the operation of some of the jacks to a greater extent than the others. Rotary cutters of diameter suitable to the requirements of the finished tunnel, and driven by electric motors, are frequently used in cutting tunnels. They commonly are provided with a conveyer to lift the debris and carry it to a chute, through which it passes into wagons for removal.

In the making of river tunnels other methods have been adopted, such as building and sinking a series of caissons and afterwards connecting them up to form the tunnel. Occasionally a channel has been dredged across a river for a tunnel and suitable piles sunk for its support. By the building of heavy timber sides and top a channel is left, which can be pumped out and kept clear by the use of compressed air, while the actual tunnel is constructed within the housing. Tunnels must commonly be faced with material such as steel plates or rings with concrete in the space between them and the earth to maintain their form and to prevent the passage of water into them. Open-cut tunneling is sometimes used, frequently in America, in the construction of underground railways. In this system a great channel is made and the tunnel constructed in it, and the ground afterwards made up.

Tunny, a spiny-finned fish of the genus Thunnus and family Scombridæ, the *T. thynnus*, closely allied to the mackerel. These fish live in shoals in almost all the seas of the warmer and temperate parts of the earth. They are taken in immense quantities on the Mediterranean coasts, where the fishing is chiefly carried on. The flesh is delicate and somewhat resembles veal. The common tunny attains a length of from 4 feet to even 20 feet, and sometimes exceeds half a ton in weight. Its colour is a dark blue on the upper parts, and silvery white below. The American tunny (*T. secundo-dorsālis*) is found on the American coast from New York to Nova Scotia. The albicore (*T. albicora*) and the bonito (*T. pelamys*) are allied species. Tunny oil is used in currying.

Tunstall, a town of Staffordshire, England, since 1910 part of the county borough of Stoke-on-Trent. Pottery and bricks are the chief manufactures; coal-mines and ironworks are located in the adjacent districts.

Tu'pelo. See *Black Gum.*

Tupper, Martin Farquhar, minor poetaster, was born in 1810, and died in 1889. He was educated at Charterhouse, and Christ Church, Oxford, and was called to the Bar, but never practised. His sole title to fame is his *Proverbial Philosophy*, which originally appeared in 1838; it was expanded into four series between 1839 and 1876. The earlier series went through almost sixty editions; a million copies were sold in America, and two hundred and fifty thousand in Great Britain. The author and the publisher made £10,000 a-piece. The success of *Proverbial Philosophy* is one of the chief curiosities of Victorian literature. The public must bear its share of the blame; for the demand for work of this kind profoundly influenced the supply. The philosophy expounded in the book is commonplace to a ludicrous extent; the language is like the inverted speech of a foreigner; and the rhythm has broken free from the shackles of metre, and resembles many English attempts at writing hexameters. Apart from his poetical effusions, Tupper was no fool. He invented safety horseshoes, glass screw-tops to bottles, and steam-vessels with the paddles inside. Of his forty literary works only one is remembered, and its fame is due not a little to the brilliant parodies of 'Cuthbert Bede' and Calverley, and the caustic allusions of Gilbert:

> "A fool is bent upon a twig, but wise men dread a bandit,"—
> Which I know was very clever; but I didn't understand it.

Turanian,[1] a term applied to all peoples of Turkic stock. They number some 48,000,000, of which 22,000,000 (Turks, Magyars, Finns) are in Europe, and the rest in Asia, and their languages are grouped together as the Ural-Altaic family (q.v.). There is no doubt that the Turanians are offshoots of a parent stock which inhabited, in proto-historic times, the steppes of Central Asia, especially the neighbourhood of the Altai-Sayan. On the northern versant of the Altai, people of Samoyedic stock are found at the present day. Linguistically, there is less affinity among Turanians than among the five main branches of the Indo-European family. Physically, the ideal Turanian type is the Mongolian, which is probably almost typical of the parent stock. The chief characteristics are muscular build, medium height; straight jet-black hair and scanty beard; broad flat face with slanting eyes, and a broad flat nose; low forehead, high cheekbones, and a yellowish-brown complexion. It was the consciousness of their ethnological affinity with peoples under Russian and Chinese rule that aroused in the Osmanlis the ambitious idea of Pan-Turanianism. The Osmanlis themselves, with the Magyars and the Bulgars, by coming into contact with superior civilizations and by the infusion of Aryan blood, have almost, if not entirely, lost their physical characteristics as Turanians. The Finns have very nearly been absorbed by the Slavs (Russians). It is worthy of note that none of the Turkic peoples have been able to emerge from their primitive state as nomads and Shamanists except those who have been associated with the Aryan peoples of the west. An exception to this general rule may be made in favour of the Manchus, probably the greatest of all the Turanian tribes. Many Manchus are Buddhists; the Osmanlis are Muslims; the Bulgars and Finns are more or less Christians; and all the others are Shamanists.

In recent years the doctrine of Pan-Turanianism has been taken very seriously in some quarters, and it has even been considered as a new dogma. But it is not new. The struggle between Aryan and Turanian is a phase in the struggle for existence that has been carried on for close on 2000 years, and it was as active and as real in the time of Zoroaster as it is to-day. The main factor in Turanian propaganda is the Osmanli Turk, whose tribe has become a state with a more or less stable government, partially through the early adoption of Islam and of Arab culture, but more largely through a capacity for military training; and although the Osmanli strain is not pure, for there is probably no purity of race in any nation, the congeries of racial types that forms the Turkish nation is held firmly together by the iron bonds of militarism.

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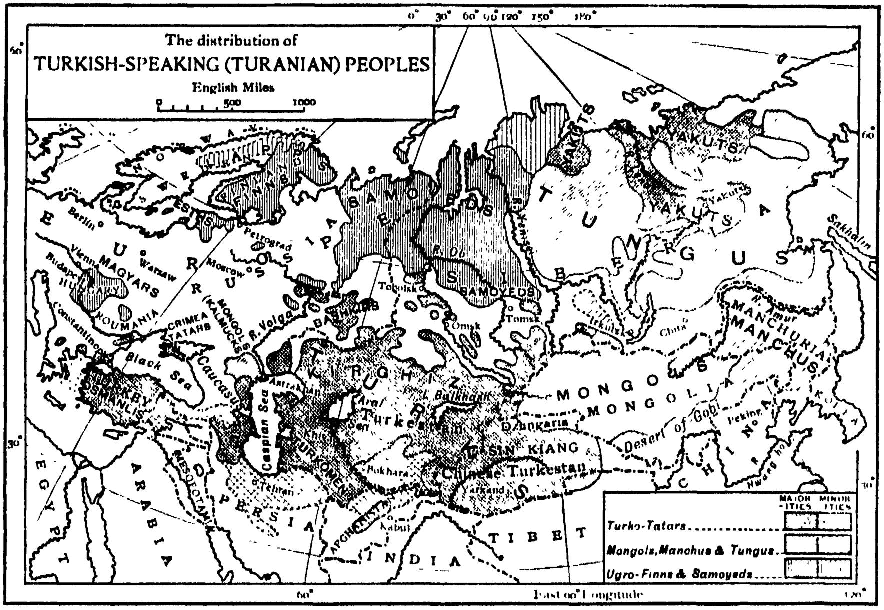
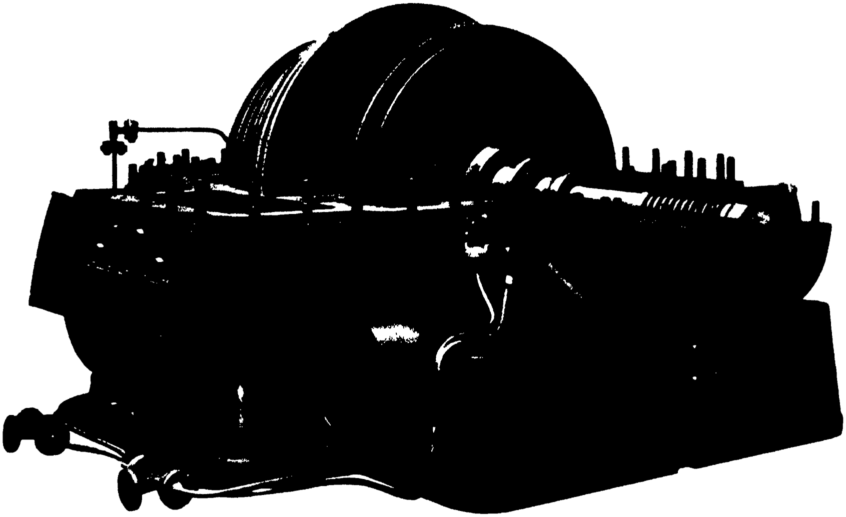
[1] The term *Tūrān*, from which the word Turanian is derived, was used in ancient Persian writings in contradistinction to *Irān* (i.e. Persia), and indicated the Transoxiana region. Firdusi in his *Shahname* or *Book of Kings* (about A.D. 1000) uses *Tūrān* in this sense, but the word appears later as *Tūra*, especially in the Zoroastrian *Avesta*. In the *Avesta* it is stated that the three sons of Thraetaona, the successor of Yima (= Noah), divided the earth just as did Shem, Ham, and Japhet in the Old Testament. These three sons were called Airya, Sairima, and Tūra respectively, and the former took Irān, the centre, and the latter Tūra, the east, the western region falling to Sairima. Irān is, of course, the modern form of the Middle Persian *Eran*, the land of the Airyana (i.e. Aryan). Tūrān or Turania was understood by the Persians as embracing the Central Asiatic region now known as Turkestan.

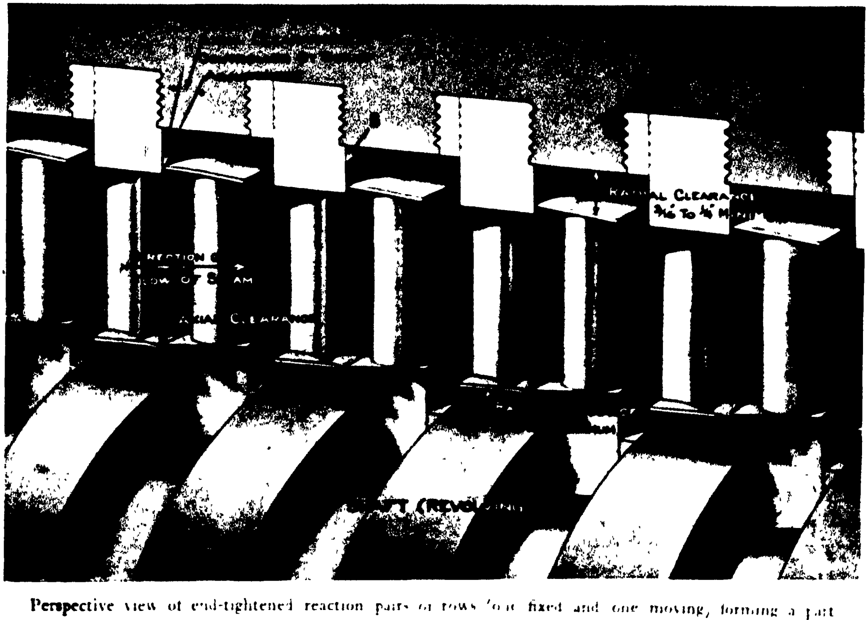


Turban (Turk. *tulbend, dulbend*), a form of head-dress worn by Mahommedan races. It varies in form in different nations, and different classes of the same nation. It consists of two parts: a cap without brim, fitted to the head; and a sash, scarf, or shawl, usually of cotton or linen, wound about the cap, and sometimes hanging down the neck.

Turbine, Steam. It is indeed strange that the steam turbine, which was the first type of prime mover to be invented, was the last to be commercially developed and applied. From the time of Hero of Alexandria to that of Sir Charles Parsons, and from the days of Branca to those of de Laval, covering many centuries, little or nothing was done to produce a purely rotative type of heat engine. In recent years there has been so much progress made that it is difficult to understand why the significance of the principles involved was for so long not appreciated. The many systems of working are based on two properties of jets of steam. The *impulse* given by the impinging of a jet upon a rotatable structure may cause its continuous revolution, or a jet may be directed through openings or blading on the periphery of the rotor with such changes of direction as make possible the use of its *reaction* to keep the turbine turning. In the first case the steam is expanded right away to its exhaust pressure, while in the other the expansion is carried out continuously in many stages. The conditions of the use of the steam in the turbine are entirely different from those of a steam-engine, in which the simple static pressure is utilized. In the impulse type of turbine the steam is passed through nozzles to expand it to the pressure of the exhaust. In that way the heat energy of the steam is first converted into kinetic energy before the conversion to mechanical work. In the reaction type of turbine the expansion of the steam and the conversion of some of the heat into kinetic energy is conducted within the nozzle channels between the blades of the rotor. There are many systems of classifying steam turbines. As they commonly take the form of combinations of the fundamental types they may be referred to by the joint names of these types or by others,



L.P. Metropolitan Vickers Impulse Marine Turbine with cover removed



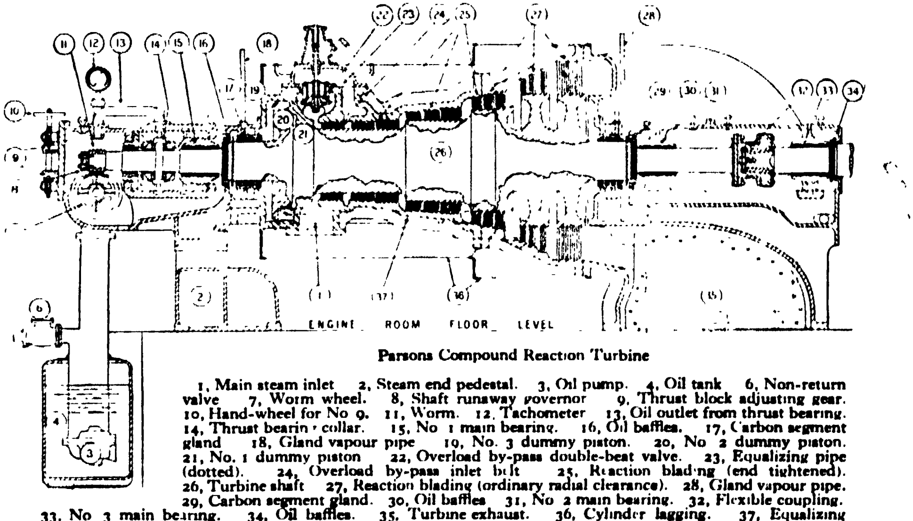
Perspective view of end-tightened reaction pairs of rows (one fixed and one moving), forming a part of the blading of a Parsons Turbine. B, B, Spacing pieces

perhaps more informative, or again by a name indicating the class of duty they have to perform They may be constructed as simple or compound sets just as is the case with steam-engines.

The pure reaction system is not commercially used, but the term reaction is employed to cover the type of machine in which the expansion is partly carried out in the space between the fixed blades and partly in those on the rotor. That is the type of action which takes place in the Parsons turbine. When an impulse turbine is combined with a reaction one the name 'combination turbine' is frequently applied. The combination turbine was introduced to get over the leakage troubles at the high-pressure end of a reaction turbine. As the blading at the high-pressure end is very short and there are mechanical limits to the reduction of the clearances, the area of passage for leakage is an appreciable proportion of the total. It may of course be got over by making the clearances axial instead of radial, but there is also the alternative of using impulse blading on discs for the first stage in the expansion. The combined impulse type of turbine shows signs of increasing favour where very large outputs are required.

The pure impulse turbine due to de Laval is manufactured by Messrs. Greenwood & Batley of Leeds in standard sizes from 5 to 500 h.p. As the whole expansion from admission to exhaust pressure is carried out in a single stage the steam speed is exceedingly high, and its kinetic energy must be taken from it by the use of a very great speed of running for the turbine. Actually the small power sets run at 30,000 revolutions per minute, while the larger ones have a speed of 10,000 revolutions per minute. The speed of running of the small de Laval turbine is believed to be the highest ever attained on any practical and useful mechanical device. To obtain a suitable speed for an electric generator driven by a de Laval turbine, gearing must be introduced and the double reduction type is favoured. A reduction of from 10 to 1 on the smaller sets, to 13 to 1 in the larger ones, is arranged for. The driving of a rigidly held shaft at such high speeds would cause endless breakdowns and trouble, and in consequence floating bearings are used which can accommodate themselves to any condition of running. The de Laval turbine may be described as a single-pressure stage turbine with single-velocity stage. This system of classifying turbines is much used. The single-pressure stage turbine is one on which all the pressure drop occurs on one set of nozzles, and the statement that it has a single-velocity stage means that the velocity is taken out of the steam on a single row of blading. The simple single Curtis wheel is a single-pressure turbine with two or more velocity stages.

A type of impulse turbine which is extensively used is that on which the heat drop is divided over a number of stages, and sets of nozzles combined with single-velocity stages. In this the heat drop in each stage may be made the



Parsons Compound Reaction Turbine

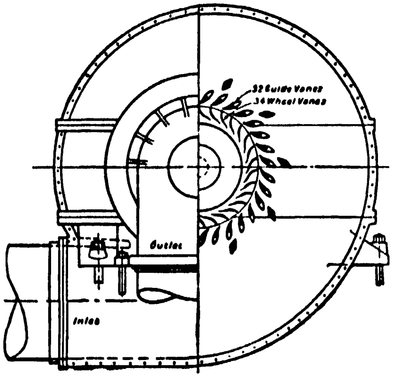
1, Main steam inlet 2, Steam end pedestal. 3, Oil pump. 4, Oil tank 6, Non-return valve 7, Worm wheel. 8, Shaft runaway governor 9, Thrust block adjusting gear. 10, Hand-wheel for No 9. 11, Worm. 12, Tachometer 13, Oil outlet from thrust bearing. 14, Thrust bearing collar. 15, No 1 main bearing. 16, Oil baffles. 17, Carbon segment gland 18, Gland vapour pipe 19, No. 3 dummy piston. 20, No 2 dummy piston. 21, No. 1 dummy piston 22, Overload by-pass double-beat valve. 23, Equalizing pipe (dotted). 24, Overload by-pass inlet belt 25, Reaction blading (end tightened). 26, Turbine shaft 27, Reaction blading (ordinary radial clearance). 28, Gland vapour pipe. 29, Carbon segment gland. 30, Oil baffles 31, No 2 main bearing. 32, Flexible coupling. 33, No 3 main bearing. 34, Oil baffles. 35, Turbine exhaust. 36, Cylinder lagging. 37, Equalizing pipe (dotted).

same, but it is usually the practice to have a larger heat drop in the first stage than in the remainder. This gives the advantages of reducing the total number of wheels required, and keeping down the maximum temperature and pressure within the turbine casing. The types of turbine of this class in common use are the Rateau and the Zoelly. When the multiple-pressure stages are combined with multiple-velocity stages, the heat drop on each step can be advantageously increased and the number of pressure stages may be cut down. The Curtis turbine is the outstanding example of this class. It has now become a common practice to combine the two last-mentioned types. The first part of the turbine is then a Curtis wheel which has two rows of blading, permitting the use of a longer heat drop on the first stage with good efficiency. In that way the Curtis-Rateau and the Curtis-Zoelly were developed.

In the reaction turbine pressure drops must occur across the moving blades as well as across the fixed ones. The blades of the Parsons turbines are not commonly increased continuously in size, but are arranged in groups, within which they have the same dimensions. In the Ljungström reaction turbine the steam passes through the blade rings in a radial direction. There are no fixed blades, but the alternate rings are connected to two discs which rotate in opposite directions.

The history of the development of the marine steam turbine began in 1804, when the Hon. Charles A. Parsons put the *Turbinia*, an experimental boat of 100 feet length, 9 feet beam, and 8 feet draught, and of 44 tons displacement, into commission. The remarkable results obtained with that boat led the Admiralty, in 1898, to use the system of propulsion in the torpedo-boat destroyers *Viper* and *Cobra*, with which very high speeds were attained, but both were lost through accidents, and the public became rather apathetic to the steam turbine. A large part of the credit for the development of the system is due to the late Mr. John Williamson, who, in 1900, approached Messrs. Denny & Co., of Dumbarton, and Messrs. Parsons with a scheme for a steamer. The enterprise of Williamson led to the successful application of the steam turbine in the *King Edward* (1901), and in the *Queen Alexandra* (1902), and the results obtained gave confidence to ship owners. Turbines were installed in increasing numbers every year, but progress was slow until the introduction of helical reduction gearing (see *Gearing*). The gearing used at first was of the single reduction type, but nowadays the use of double reduction gearing in large turbine-driven merchant ships is almost universal.

Turbine, Water, a machine in which the energy of a jet of water is converted into mechanical rotation. It consists of a series of blades or vanes on a cylindrical frame mounted on a shaft, and the jet impinges on these blades in turn and causes the rotation of the shaft. Turbines are of two classes, *impulse* and *reaction* turbines. Of the former the Pelton wheel, and of the latter the Francis turbine are the most modern types. In an impulse turbine the whole head of the supply water is converted into kinetic energy before the wheel is reached. The water leaves the nozzle or nozzles in one or more high-velocity jets, which are exposed to the pressure (usually atmospheric) obtaining in the turbine casing. It then impinges on a series of buckets carried by the wheel, and, in virtue of the change of direction and momentum produced by the buckets, exerts a driving force. The pressure of the water remains uniform during its passage through the turbine.

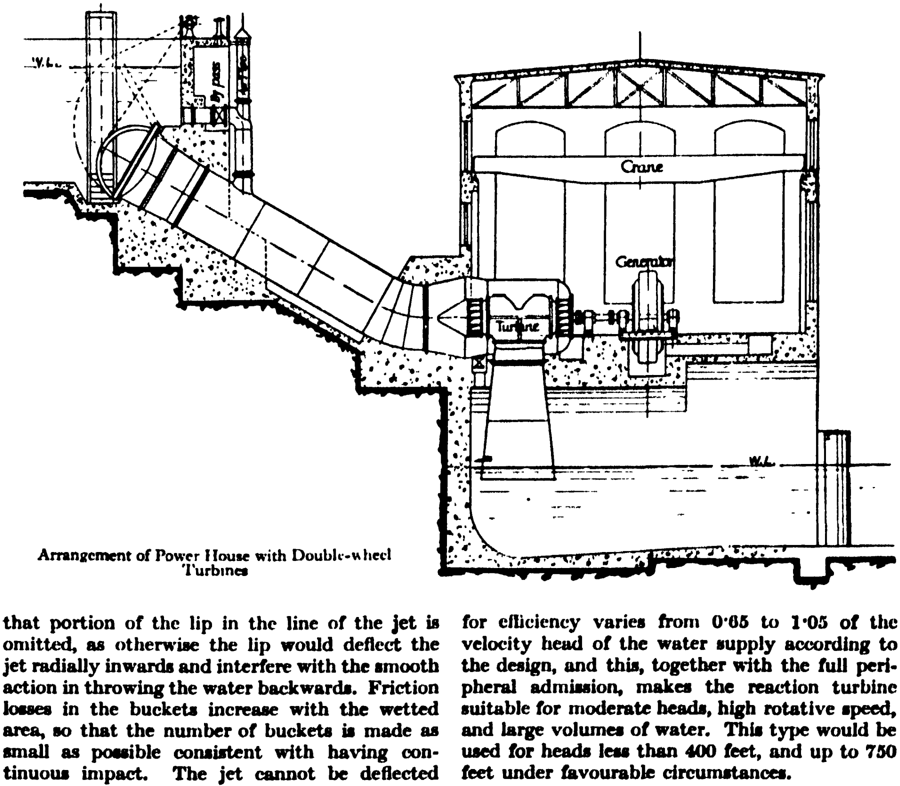


Francis Turbine

The peripheral velocity of a Pelton wheel for maximum efficiency is slightly less than half the spouting velocity of the jet, and for this reason it enables the rotative speed to be kept within moderate limits. Since the design does not lend itself to the efficient use of more than two jets on a single wheel, and as the maximum practicable jet diameter is about 12 inches, the Pelton wheel is well adapted for small volumes of water at very high heads. The used water discharges directly into the tail-race, so that where the tail-race level varies appreciably the wheel must be placed above the highest tail-water level, with some sacrifice of head. For heads between 400 and 750 feet the choice of Pelton wheel or reaction turbine depends largely upon local circumstances and on power required, but for heads greater than 750 feet the Pelton wheel is preferable. The greater simplicity and accessibility of the parts requiring replacement from wear and tear render the Pelton wheel suitable when the supplying stream carries grit or silt in suspension. The nozzle is always circular in section, with axial needle or *spear* for regulating the size of jet, by partially closing up the nozzle orifice. Other shapes of jet suffer greater loss by windage, and tend to become circular and to become unsteady in the process. For high efficiency the diameter of the pitch circle of the buckets should not be less than about twelve times the diameter of the jet. The buckets are shaped with a knife-edged central ridge, so as to split the jet and give it a backward deflection as smoothly as possible. To avoid loss of energy, that portion of the lip in the line of the jet is omitted, as otherwise the lip would deflect the jet radially inwards and interfere with the smooth action in throwing the water backwards. Friction losses in the buckets increase with the wetted area, so that the number of buckets is made as small as possible consistent with having continuous impact. The jet cannot be deflected through the full 180° without fouling the back of the following bucket, 165° being about the maximum deflection. The width of buckets is about three to four times the diameter of the jet, the ratio diminishing as the jet size increases.

The *pressure* or *reaction turbine* consists essentially of a wheel, or *runner*, with vanes into which water is directed over the whole periphery by a series of *guide vanes*. The water on leaving the guide vanes is under pressure, and supplies energy partly in kinetic and partly in pressure form. In passing through the runner the pressure increases the relative velocity of flow between the vanes, and the water finally leaves the runner at the pressure existing in the discharge pipe. The earliest type of reaction turbine had the guide vanes inside the runner, giving *outward flow*. This was followed by a type with the guide vanes above the runner giving *axial flow*. The modern type of Francis turbine has *inward flow*, but in order to obtain a large discharge area the buckets are formed to discharge in a direction nearly parallel to the axis. The peripheral speed for efficiency varies from 0·65 to 1·05 of the velocity head of the water supply according to the design, and this, together with the full peripheral admission, makes the reaction turbine suitable for moderate heads, high rotative speed, and large volumes of water. This type would be used for heads less than 400 feet, and up to 750 feet under favourable circumstances.

The water supply to the runner is regulated either by *cylinder gate* or by *pivoted guide vanes*. With cylinder gates excessive eddy formation at part gate gives low part-load efficiencies, but the cheapness and reliability make it of use in small plants. Guide vanes are commonly made of cast steel, but under very high heads where the water carries grit, bronze vanes may be used to resist erosion. The corrosion of the runner under high heads, even with non-gritty water,



Arrangement of Power House with Double-wheel Turbines may be due to faulty design of the vanes leading to excessive eddy formation. The pressure at the core of such eddies is comparatively low, leading to the liberation from solution of air apparently containing nascent oxygen, which rapidly attacks and pits any iron or steel surface. For a similar reason corrosion is pronounced at high heads if the turbine is operated much at part gate. If the guide vanes are pivoted, they are all attached to a ring, by the rotation of which all the vanes are closed or opened at the same time and uniformly. The rotation of the ring is controlled by the governor. The casing, bringing the supply water to all portions of the periphery of the runner, is of spiral volute form, and may be formed by moulding within the concrete substructure of the turbine itself if the head does not exceed about 100 feet. For higher heads a metal casing is required for strength, and is formed of steel plates or cast steel. The two sides of the casing are tied together by a series of spacers surrounding the guide vane ring. These are shaped so as to guide the water into the guide vanes and form the *speed ring*. This ring occurs also in the concrete volute chambers of vertical shaft units, being formed by the columns which transmit the weight of the unit to the concrete substructure. The reaction turbine may either be submerged in the tail-water or may discharge into a *draft-tube* when the turbine is placed at a height above the tail-water. The maximum practical elevation depends on the diameter of the draft-tube, decreasing with an increase in diameter. This draft-tube may be designed with increasing area of cross-section, so that a large proportion of the kinetic energy of the discharge water may be converted into pressure head and utilized in this form. See *Hydraulics and Hydraulic Machinery*; *Breast Wheel*; *Overshot Wheel*; *Undershot Wheel*; *Hydro-electric Engineering*.—BIBLIOGRAPHY: A. H. Gibson, *Hydro-electric Engineering*; *Hydraulics and its Applications*; F. C. Lea, *Hydraulics*.

Turbot (*Rhombus maximus*), a valuable food-fish of the family Pleuronectidæ or flat-fishes. Next to the halibut, the turbot is the largest of the Pleuronectidæ found on the British coast, and is the most highly esteemed for the table. It is of a short and broad form, brown on the upper side, which is usually the left side, and attains a large size, weighing 20 lb. or more. The American or spotted turbot (*R. maculatus*), common on the coasts of New England and New York, attains a weight of 20 lb.

Turcoman, or Turkmen (the latter being the correct form), a Turanian people occupying mainly the Trans-Caspian division of the Soviet Republic of West Turkestan (see map under *Turanian*), and distributed in smaller numbers over Afghan Turkestan, North-Western Persia, Anatolia, &c. The Turkmen are divided into seven chief tribes, of which the Salors are the oldest and noblest, and their total number is about 290,000. They have a primitive civilization, and prior to their subjugation by Russia they were a fierce bellicose people; but they are now more or less peaceful, and such tribes as the Göklens, the Yamut, and the Ersaris have to a large extent forsaken the traditional nomadic life and have settled down to agriculture, &c.

Turenne, Henri de la Tour d'Auvergne, Vicomte de, French soldier, born in 1611 at Sedan, died 1675. The second son of Henri de la Tour d'Auvergne, Duke of Bouillon, and of Elizabeth, Princess of Nassau-Orange (a daughter of William the Silent), he learned the art of war under his uncles Maurice and Henri of Nassau in the Dutch service. He entered the service of France in 1630, served with distinction in Germany and North Italy, and in 1643 received the command of the army of the Rhine in the Thirty Years' War, and was made a marshal. His successes in this post, as in the battle of Nördlingen (1645), greatly helped to win the war. During the disturbances of the Fronde the victories of Turenne led to the termination of the Civil War. In the war against Spain he also distinguished himself, and after its close in 1659 he was named marshal-general of France. When war was renewed with Spain in 1667 he conquered Flanders in three months. In the Dutch War of 1672 Turenne had the chief command. He first marched against the Elector of Brandenburg, and, having driven him back as far as the Elbe, forced him to sign the Treaty of Vossem in 1673; while in the brilliant campaign of 1674–5 he destroyed two Austrian armies in the battles of Mühlhausen and Türkheim, and conquered and devastated the Palatinate. He was killed while making preparations to engage Montecuculi.

Turgot (tür-gō), Anne Robert Jacques, French economist and statesman, born 1727, died 1781. He was educated for the Church, but studied law, and in 1761 was appointed intendant of Limoges, which post he occupied for twelve years. Shortly after the accession of Louis XVI in 1774 Turgot was appointed Comptroller-General of France, and in order to reform the political and financial condition of the country, he moderated the duties on articles of the first necessity, freed commerce from many fetters, and encouraged industry by enlarging the rights of individuals, and abolishing the exclusive privileges of companies and corporations. Such, however, was the opposition of the clergy and nobility to his reforms that he was dismissed from office in 1776, and retired into private life.—BIBLIOGRAPHY: W. W. Stephens, *Life and Writings of Turgot*;

F. de Ferry, *Les Idées et l'Œuvre de Turgot en matière de droit public.*

Turin', a mountainous frontier province of Piedmont, North Italy, whose boundaries march with the Swiss and French frontiers; drained by the head waters of the Po. Coal, copper, &c., are found, and cattle are raised. Cottons, linens, silk, and nuts are exported. Turin is the capital. Area, 3953 sq. miles; pop. 1,252,000.

Turin (ancient **Augusta Taurinorum**; It. *Torino*), a city of Piedmont, North Italy, capital of the province of Turin, at the confluence of the Dora Riparia with the Po, and between those two rivers; the centre of railways from Aosta, Genoa, Cuneo, Modane, Rivoli, Chieri, Savona, Mailand, &c., and of steam-tramways to Saluzzo, &c. The chief buildings are the cathedral, a Renaissance building, completed in the beginning of the sixteenth century, and remarkable for its marble façade; the royal palace, a plain brick building, which contains the king's private library, with valuable MSS., and the royal armoury; the university; the Palazzo Carignano, used at one time by the Sardinian and Italian Parliaments when they met here (1848–65), and now given up to a collection of natural history; and the Madama Palace, in the Piazza Castello, the hub of the city's daily life. Among the educational establishments, besides the university, are the episcopal seminary, Royal Military Academy, and a polytechnic school. Manufactures consist, besides the staple of silk, chiefly of woollens, cottons, linen, paper, ironmongery, earthenware, and porcelain.

In Roman times Turin was the chief town of the Taurini, was conquered by Hannibal (218 B.C.), and became a colony, receiving under Augustus the name *Augusta Taurinorum.* From the eleventh to the fifteenth century it was alternately in possession of France and Savoy, when it became, until 1860, capital of the Kingdom of Sardinia and, until 1865, of United Italy. Pop. 502,300.

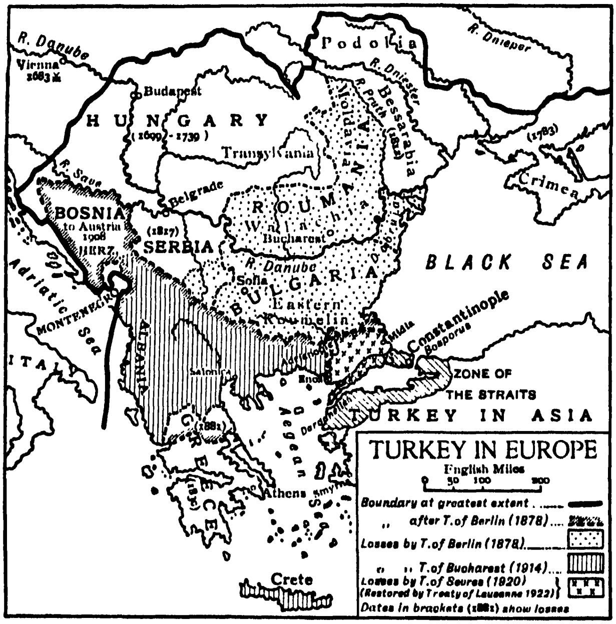
Turkana, a negro tribe of Uganda, occupying mainly the Turkana and Dabossa districts of Rudolf Province, but allied linguistically, &c., to the Karamojo of Uganda and Kenya. They are of great stature (average 7 feet), and depend upon cattle, and fish from Lake Rudolf and the swamps, for a livelihood, sheep and goats being raised in enormous numbers, cattle largely bred, and camels and donkeys kept. Their steppeland is arid and almost Saharan at times, the annual rainfall never exceeding 10 inches, and sometimes failing entirely for several years. The Turkana are nomads, but the Karamojo are more settled and have some commerce and agriculture. Their chief features are: Clothing, nil; ornaments, few; no circumcision; wonderful hairdressing, the hair of ancestors being made up and worn; great hunters; arms, spear and wrist knives; an everlasting pest to European administrators.

During the European War the Turkana caused grave trouble. At the end of 1914 they carried out a cattle-raid, and the Uganda Police, assisted by Sudanese troops, surprised them at Pelegech Mountain, taking many cattle. Early in 1915 a larger expedition became necessary, during which the paramount chief of the Turkana lost a large number of followers and many cattle. From that time efforts have been made to force the tribes into the Sudan or to reduce their number.

Turkestan, a wide region of Central Asia, roughly divided into two portions, Eastern Turkestan and Western Turkestan. Eastern or Chinese Turkestan is enclosed on three sides by lofty mountain ranges (Thian-Shan, Karakorum, Kuen-Lun), and on the east has the desert of Gobi. Near the centre is the basin of the Lob-nor, marshes fed from the west by the Tarim and its tributaries. The greater part of this area is uncultivated steppe, but there are fertile portions watered by the Rivers Kashgar, Yarkand (q.v.), and Karakash. The products include cereals, root-crops, and cotton in large quantities, partly manufactured in the country. Carpets and felt cloths, along with silk, which the country produces abundantly, are exported to India, Kashmir, and Tibet; while opium, tea, linens, and woollens are imported. The inhabitants are Mahommedans. In 1863 a rebellion broke out, and after a war of several years Eastern Turkestan succeeded, under Yakub Beg, in effecting its separation from the Chinese Empire, but after his assassination in 1877 it was again brought under Chinese sway. The chief towns are Kashgar and Yarkand, and the population is estimated at 580,000.

Turkestan, West, an autonomous Soviet Republic of Central Asia, comprising the six provinces of Semiretchinsk, Samarkand, Ferghana, Syr Darya, Trans-Caspia, and Amu Darya, with Tashkent as administrative centre and headquarters of the Central Executive Committee (75 members): Provincial Executive Committees, each of which send one member to Tashkent, are charged with local (provincial) government; and from Tashkent the Central Executive Committee dispatches delegates to Moscow. West Turkestan is mainly Mahommedan, and the tenets of bolshevism being opposed entirely to Koranic precept, the vast bulk of the Mussulman population will have nothing to do with the Soviet; so that the country is in the anomalous position of being governed by a Russian minority representing roughly 4·75 per cent of the population. The area of the Republic is 577,400 sq. miles, and the pop. about 7,300,000.

Turkey, a state in the Near East comprising the Anatolian Peninsula (Asia Minor) and part of Thrace (European mainland).



Physiography: Anatolia.[1]—The exact boundaries of Anatolia are rather vague physically, but they are clear enough politically. Physically, the country forms an extension towards Europe of the Iranian Plateau, cut transversely into halves by the Anti-Taurus range, and flanked on all sides by mountain ranges like buttresses. The general slope of the plateau is from east to west, from the mountain knot of Armenia (8000 feet altitude) to the Ægean escarpments (1000–1500 feet altitude); and the average breadth is from 300 to 400 miles. The plateau consists of great, undulating, scrub-covered plains, broken here and there by isolated volcanic necks (Erjias Dagh—twin cones—11,830 feet altitude), a region of short scorching summers and long freezing winters when the temperature in the eastern area is frequently as low as −20° F.[2] A feature of the plateau, west of the Anti-Taurus, is the Salt Plain, comprising Tertiary lacustrine deposits; and the fringe of lakes among which Tuz Geul (salt) is conspicuous and is the centre of a large area of inland drainage. In flora, fauna, and climate the whole region is indistinguishable from the Russian steppes. The rim-mountains and coastal plains may be considered regionally. (1) In the north is the Black Sea or Pontic zone, distinguished by its broad mountain range, which slopes gently southwards to the plateau, but presents a steep, almost abrupt, face rising from the Black Sea on the north. Few river valleys penetrate the mountains, and the small deltaic littoral-plains formed by the swift-flowing rivers Kizil-Irmak and Yeshil-Irmak are of great importance. Samsun and Trebizond are the centres of practicable routes to Sivas and Central Asia respectively. The Sakaria River also flows into the Black Sea, and is navigable for over 100 miles by small craft; but none of the Anatolian rivers is navigable to any extent. The climate of the Pontic zone is distinguished by its heavy rainfall. The mountains intercept the moisture-laden north winds, which, as dry blasts, pass over the plateau of the interior. This accounts for the semi-arid nature of the largest part of the plateau, where the maximum rainfall occurs in spring. In the Pontic zone the winters are cold and damp, with frequent snowfalls; but the summers are warm. (2) In the south is the Taurus range (6000–9000 feet altitude), higher and less broken than the Pontic, and presenting also a steep escarpment to the sea, except around Adana, which lies in the unhealthy plain of Cilicia, and at Adalia, in the Pamphylian plain. Through the Taurus to the hinterland the only road is by the narrow gorge of the Cilician Gate, behind Adana, and this is used by the railway. The chief rivers are the Sihun and Jihun, both reaching the Mediterranean through the Cilician plain. As in the west, the climate of the southern zone is of a Mediterranean type, but colder in winter and warmer and drier in summer. (3) The western or Ægean zone is the richest and most pleasant of Asiatic Turkey. Rias, such as those of South-Western Ireland or North-Western Spain, penetrate far into the mainland, separated from each other by narrow, dissected fingers of the main plateau.

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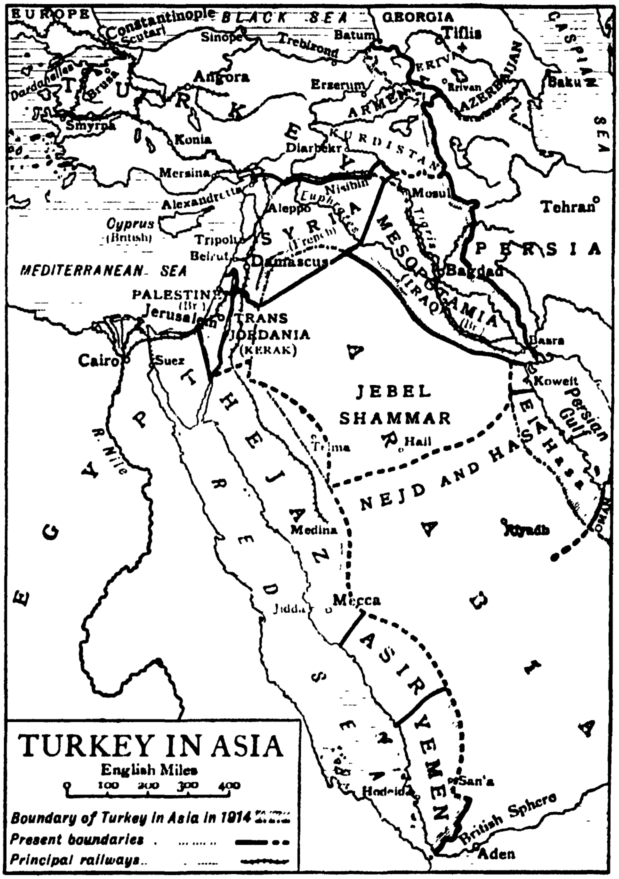
[1] For convenience of reference Constantinople and the circumjacent region of Thrace have been treated separately under *Thrace*, apart, of course, from the article *Constantinople*, dealing with the city proper.

[2] Erzerum (in Armenia) has frequently been called 'the Anatolian Verkhoyansk'.

It is here that East really meets West, that Europe and Asia rub shoulders not only geographically, but also historically. The Marmara littoral in part, and the zone of the Straits may be considered as part of the western zone. The mountains are much broken as the coast is approached, and the historic valleys of the Gediz Chai (*Hermus*) and Menderes Chai (*Mœander*) form easy lines of communication with the plateau. The latter valley has many thermal springs.[1] In the north-west of this zone there is a freshwater lake district (around Brusa), the most important lakes being Abulliont Geul, Isnik Geul, and Maniyas Geul; the atmosphere is very clear and exhilarating, and the excellence of the climate is surpassed only by the magnificence of the fauna and flora. Smyrna is the metropolis of the Ægean zone.

Resources: Agriculture. — Anatolia is agriculturally very backward, for reasons which are discussed elsewhere, but, generally speaking, there are fine wheat-lands on the plateau, especially around Eskishehr and Afium Karahissar, and in the neighbourhood of Sivas. Central Anatolia is also a suitable stock-raising region, where there is at present a considerable industry centring on Angora, and including the northern or plateau region of the vilayet of Konia. Among animals bred, the most interesting is the Angora goat, which furnishes mohair; but of equal importance are the camel (Syrian and mule-camel), mule, sheep, and donkey. The richest and best-developed region of Anatolia, from an agricultural standpoint, is Aidin, which occupies the favoured Ægean zone; the most backward is the rugged, inhospitable, and inaccessible vilayet of Kastamuni, in the Pontic zone. Actual production is as follows:

Cereals.—North-West and Marmara zone, Aidin, Kastamuni, Cilician plain, Angora, Konia. *Silk.*—The chief production of Brusa vilayet and Sanjak of Bigha; also produced by Ismid Sanjak. *Tobacco.*—Pamphylian plain, Aidin, Marmara littoral, Ismid Sanjak Brusa district; Samsun is the chief centre of tobacco-growing. *Honey and Wax.*—Ismid Sanjak. *Olives and Fruit.*—Marmara littoral, Aidin (olives, figs, and raisins), Pamphylian plain, Kastamuni, Angora (apples and pears). *Liquorice.*—A wild-growing product from the valleys of the Mæander river-system.



"Present boundaries" are shown as in 1923

Sugar-cane.—Cilician plain. *Poultry and Eggs.*—Aidin, Ismid Sanjak. *Opium.*—Marmara littoral, Cilician plain, Ismid Sanjak. *Cotton.*—Cilician plain, Marmara littoral, Aidin, Pamphylian plain. *Valonia.*—Pamphylian plain, Kastamuni, Marmara littoral, Aidin. *Rice.*—Cilician plain and around the Lake of Isnik are the main regions. *Wool, Mohair, Hides.*—Angora and Kastamuni. *Barley*, much in demand by European maltsters for the making of whisky, is grown largely in the eastern plateau, Brusa, and the Sanjak of Bigha.

The mule-camel mentioned above is obtained by mating a Bactrian sire and a Syrian dam, and has exceptional mountaineering qualities.

Forests and Fisheries.—The vast forests of

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[1] *Springs.*—Its variety of thermal springs is a peculiarity of Anatolia. Among a large number, those of Eskishehr, Hierapolis, Brusa (sulphur and iron, hot springs), Boli, and Khavas may be mentioned. Seismic disturbances of great violence shake the country periodically.

Anatolia have suffered somewhat from indiscriminate felling, but they are still of large extent and of great potential value. Trees include: oak (including Valonia oak), walnut, pine, cedar (in Aidin), larch (in Konia), elm, beech, lime, plane, hornbeam, fir, and chestnut. Gall nuts (q.v.) are normally produced in the Sanjak of Bigha and the vilayet of Kastamuni. Fisheries (coastal, lake, and stream) are valuable, but almost entirely undeveloped. *Minerals.*—The mineral wealth of Anatolia may have been at times exaggerated, but it is undoubtedly great, although almost entirely representing potential wealth, for there has been little or no systematic exploitation, excepting a partial boom during the European War, when Germany and the Central Powers made extraordinary demands upon Anatolian resources. The chief minerals are: coal (see *Songuldak*) and lignite; meerschaum, from the Eskishehr deposits (State-owned), which form one of the world's few great sources of supply; pandermite (boracite), worked along the railway running inland from Panderma, especially around Susigirli; chromite (one of the chief ores of chromium), from the vilayets of Aidin and Brusa; emery, from the Aidin vilayet (especially southeast of Smyrna), where the workings are very important; argentiferous and auriferous lead, usually associated with zinc, found near Balia-Maden, Berektli-Maden (north-east of Bulgar-Maden), and at Bulgar-Maden in the Bulgar-Dagh (Konia district), where there is a State-owned mine that has been continuously worked since Hittite times. Known minerals other than the foregoing are as follows: antimony, at many places, but around Nazilly in Aidin vilayet especially; mercury, in Aidin vilayet; nickel, found near Kastamuni; salt, worked in large quantities both as rock-salt and from springs and dry pans; fuller's earth, a lucrative product principally found in Angora vilayet (at Michalijik); some iron; copper (deposits perhaps exhausted); sulphur; iron pyrites; manganese.

Manufactures.—Anatolian manufactures are almost entirely undeveloped, but carpets, as a cottage-industry, are important. The basis of this industry is the mohair of the Angora goat; the madder and valonia for dyeing it are produced from specially grown species of oak. Aidin vilayet is the greatest carpet-producing region. Brusa is the centre of a silk-producing region, and there is some production of silk fabrics as well as of cottons. Smyrna leads all Anatolia as far as industrial enterprise is concerned.

Trade.—A peculiarity of trade in Anatolia is that it is adversely influenced by religious observances. Friday, Saturday, and Sunday are holy days of Mahommedan, Jew, and Christian respectively, and none of them will buy or sell upon his sacred day. This imposes a heavy burden on the rest of the week, and is an unsatisfactory arrangement when compared with European standards. Considerable development of transport facilities and agricultural exploitation will be necessary before Anatolia ranks as economically alive. The main imports are textiles, flour and cereals, woollens, silks, sugar, metals, oils, fats and soaps, and animal products. Exports are mainly tobaccos, dried fruit, wool and mohair, olive-oil, skins, silk, cotton and cotton-goods, and opium.

Ports and Towns.—Angora is the capital of Nationalist Turkey; Konia is rapidly becoming an important centre of trade, and has adjacent sugar plantations; Kaisariah; Brusa is the only really important inland town (pop. about, 90,000). Ports are distributed according to zones. On the Black Sea are Trebizond, Samsun, Sinope, and the Heraclea coal-field ports (see *Songuldak*), with Eregli. Marmara ports include Ismid, Gemlik (pop. 5000), Mudania (5000), Panderma, and Chanak on the Dardanelles (22,000). Mediterranean ports include Aivali (60,000), Dikeli, and Smyrna in the Western or Ægean zone; and Marmarice, Makri, Adalia, Mersina, and Ayas in the Pamphylian-Cilician littoral. Ayas Bay is the finest deep-water port on the south coast.

Ethnology.—What is a Turk? This question has frequently been expressed as the conundrum, "When is a Turk not a Turk?" and in the days of the Committee of Union and Progress there was but one answer, "When he's a Young Turk", for it is notorious that many of the most influential revolutionaries were not Turks at all. The Ottoman Empire presented, and Nationalist Turkey still affords, a peculiar example of a powerful *state* that is not a *nation*. There is no such thing as a Turkish nation as the word is generally understood, for Turkey is a congeries of discrete peoples who are not so much to be distinguished by nationalities as by religions; and under the Empire the name of their religion formed the political designation of the various races. Sunnite Mahommedanism was the State faith, and the Sultan was Caliph of Islam, the vicar of God;[1] but provision was made for the granting of almost complete autonomy to certain religions, of which the adherents were grouped together in *millets* and sent representatives direct to Constantinople.

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[1] Sunnite Mahommedanism and the Caliphate maintain their position in Nationalist Turkey. The Sultan of Turkey is the *generally* recognized spiritual head of Islam, and his position resembles that of H.M. The King Emperor as *Defender of the Faith*, in that it is admitted by some without question, but accepted rather unwillingly by others. As regards the *millets*, it has been cleverly suggested that as bigamy is not a recognized crime in Turkey, it was essential to the well-being of any Christian community domiciled there that it should have power to deal with offences in this and any other respect at variance with Mussulman practice. Apart from that, the system afforded the Christians a splendid opportunity of acquiring a wide education and culture, which rather discredits ill-informed reports regarding the educational backwardness of the entire people. Nominally, of course, elementary education was, by law, compulsory between the ages of seven and sixteen years. The much-advertised atrocities appear to have been exaggerated, despite the cold-blooded extirpation schemes (alleged) attributed to Talaat Pasha, and it is an actual fact that there

Nationalist Turkey is a congeries of peoples just as was the old Ottoman Empire; but the main point to be distinguished is that the Nationalist State is preponderatingly Muslim, and claims not so much to be a European Power as to be a free Asiatic Sultanate. This recalls the fact that Asiatic Turkey in general, and Anatolia in particular, was always the bulwark of the Ottoman power during the Imperial régime, despite the centralization of administration at Constantinople. At the moment, Anatolia is a political entity governed from within, a state of affairs which has not obtained since Hittite times. The various races comprising the Turkish State are as follows: *Armenians* (Catholic and Gregorian), found in Adana, Sivas, Angora, and Trebizond regions; *Kizilbashis* (pagans with a thin Islamic veneer), Angora-Amasia region and around Tokat; *Jews*, Marmara littoral, Bosporus, and all large towns; *Arabs* (Muslim), in Adana; *Greeks*[2] (Orthodox mainly), Adana, Aidin, Konia, Angora, Kastamuni, Trebizond, Sivas: generally scattered all over, with a percentage of European Greek immigrants around Smyrna; *Kurds* (Muslim), Angora and Sivas; *Lazes* (people of Caucaso-Tibetan race — mainly Muslim), scattered all over, but mainly found in the hills of Trebizond; *Circassians* (Muslim), have many settlements; *Gipsies* (Muslim), found all over; *Abkhasians* (Muslim); and Tatars, Turkmen, Avchar, and Yuruks, all nomadic people of Turanian origin. The miscellany of races is due primarily to the peculiar geography of Asia Minor, which made it in ancient times a battle-ground on which the fate of empires was decided. *Turks.*—It is exceedingly difficult to discuss the word 'Turk' from an ethnological standpoint, for it is identical in meaning with Turanian (q.v.). Muslim adherents of the House of Osman call themselves 'Osmanlis', not 'Turks', although apostles of Pan-Turanianism (q.v.) have endeavoured to give the name a special significance. Politically, a Turk is an Osmanli (as mentioned above), although Arabs, for example, are scarcely to be considered as such. Linguistically, Turkish forms a division of the Ural-Altaic family of languages (q.v.). Space does not permit of a lengthy discussion of the various reasons 'why a Turk is not a Turk', but, generally speaking, it is safe to confine the application of the name to the people who conquered and still govern Constantinople, and who have racial and linguistic affinities with the Turanian peoples discussed under *Turanian*.

History.—The Ottoman Turks came originally from the region of the Altai Mountains, in Central Asia, and in the sixth century A.D. pushed onward to the west in connection with other Turkish tribes. Early in the eighth century they embraced Islam, and in the thirteenth century they appeared as allies of the Seljuks (q.v.) against the Mongols, and for their aid received a grant of lands from the Seljuk Sultan of Iconium, in Asia Minor. Their leader, Othman or Osman, of the race of Oghuzian Turcomans (Turkmen), became the most powerful emir of Western Asia, and after the death of the Seljuk Sultan of Iconium (1300) he proclaimed himself Sultan. He died in 1326. Thus was founded upon the ruins of the Saracen, Seljuk, and Mongol power the Empire of the Osmanlis or Ottoman Turks in Asia; and after Osman, the courage, policy, and enterprise of eight great princes, whom the dignity of Caliph placed in possession of the standard of the Prophet, and who were animated by religious zeal and a passion for military glory, raised it to the rank of the first military Power in both Europe and Asia (1300–1566).

The first of them was Orkhan (1326–59), son of Osman. He subdued all Asia Minor to the Hellespont, took the title of *Padishah*, and became son-in-law to the Greek emperor Cantacuzenus. Orkhan's son, Suleiman, first invaded Europe in 1355. He fortified Gallipoli and Sestos, and took possession of the straits now called the Dardanelles. In 1360 Orkhan's second son and successor, Murad I (1359–89), took Adrianople, which became the seat of the empire in Europe (1367), conquered Macedonia, Albania, and Serbia, and defeated a great Slav confederation under the Serbian king Lazar I at Kosovo (1389), but was assassinated just after the victory, and Bayezid, surnamed *Ilderim* (lightning), was proclaimed king on the field as Bayezid I

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is much less agreement between different Muslim nationals than there is between Christian and Christian, and Christian and Muslim. For example, the bullying, arrogant Circassian from the Caucasus, whence he was driven (along with the Abkhasians) by the Russian occupation, stirs up strife wherever he goes, and is entirely incapable of living in harmony with his Muslim brethren, with whom the Christians and Jews are seldom in trouble.

Nationalist Turkey shows even more clearly than the old Empire that the binding force which cements this racial miscellany into some semblance of an orderly community is the dominant military caste, which is linked up with Islam all over the world through the Royal House of Osman, whose lineal descendant wears that warrior's sword and is nominally master in the house that, since the deposition of Abdul Hamid, has been ruled by free-thinking Young Turks, with a larger share of worldly knowledge and a smaller love of Islam and the Prophet than their ancestors would have dared even to aspire to.

[2] By Greeks are meant those who became 'Greeks' during the period when Asia Minor was more or less hellenized, a period which ended in the sixth century A.D. They became 'Greeks' politically, and as such they have always been considered. Thus it is that the Anatolian 'Greeks' are descendants of the Byzantine Anatolians, and are politically, linguistically, and theologically (but not racially) Greek. The common racial stock is identical, but one branch embraced Islam, the other Christianity; and although the two have developed side by side, time has only served to make the cleavage in sympathy absolute.

(1389–1403). He invaded Thessaly, and also advanced towards Constantinople. In 1396 his Janissaries defeated the Western Christians under Sigismund, King of Hungary, at Nicopolis, in Bulgaria; but at Angora in 1402 he was himself conquered and taken prisoner by Timur the Lame, who divided the provinces between the sons of Bayezid. Finally, in 1413 the fourth son of Bayezid, Mahommed I (1413–21), seated himself upon the undivided throne of Osman. In 1415 his victorious troops reached Salzburg and invaded Bavaria. He conquered the Venetians at Thessalonica in 1420; and his grand-vizier, Ibrahim, created a Turkish navy. Mahommed was succeeded by his son, Murad II (1421–51), who defeated Ladislaus I, King of Hungary and Poland, and John Hunyadi at Varna in 1444. Mahommed II (1451–81), the son of Murad II, completed the work of conquest. He attacked Constantinople, which was taken on 29th May, 1453, and the Byzantine Empire came finally to an end. Mahommed II added Serbia, Bosnia, Albania, and Greece to the Ottoman Empire, and threatened Italy, which, however, was freed from danger by his death at Otranto in 1481. He was surnamed *The Conqueror*, and to him was due the Ottoman administrative system, which existed intact down to the time of Mahmud II; and the organization of the *ulema* was his crowning work. His grandson, Selim I (1512–20), who practically deposed his father, Bayezid II (1481–1512), conquered Egypt and Syria. Under Suleiman I (*The Magnificent*, 1520–66), the Ottoman Empire reached the highest pinnacle of power and splendour. In 1522 Suleiman took Rhodes from the Knights of St. John, and by the victory of Mohacs in 1526 subdued half of Hungary. He exacted a tribute from Moldavia, made Bagdad, Mesopotamia, and Georgia subject to him, and threatened to overrun Germany. Suleiman had as an opponent Charles V of Germany, as an ally Francis II of France, but he was checked before Vienna (1529), and this episode forms the high-water mark of Turkish success. From this time the history of Turkey is a story of disintegration and decay, which culminated in the Treaty of Sèvres (1920), the end of the Ottoman Empire, and the rise of a new Turkey, like a Phœnix from the ashes of the old.

In the latter part of the sixteenth century, and most of the seventeenth century, the chief wars were with Venice and with Austria. The battle of Lepanto (1571), in which the Ottoman fleet was overthrown by the combined fleets of Venice and Spain, was the first great Ottoman reverse at sea; and the battle of St. Gothard (1664), near Vienna, in which Montecuculi defeated the Vizier Kuprili, the first great Ottoman reverse on land. In 1683 Vienna was besieged by the Turks, but was relieved by John Sobieski and Charles of Lorraine; in 1687 the Turks were again defeated at Mohacs, and in 1697 (by Prince Eugène) at Szenta. Then followed the Treaty of Karlowitz in 1699, by which Mustapha II (1695–1703) agreed to renounce his claims upon Transylvania and a large part of Hungary, to give up the Morea to the Venetians, to restore Podolia and the Ukraine to Poland, and to leave Azov to the Russians. Eugène's subsequent victories at Peterwardein and Belgrade obliged Ahmed II (1703–30) to give up, by the Treaty of Passarowitz in 1718, Temesvar, Belgrade, with a part of Serbia and Wallachia; but the Turks, on the other hand, took the Morea from Venice, and by the Treaty of Belgrade in 1739 regained Belgrade, Serbia, and Little Wallachia, while for a time they also regained Azov.

Russia, which had been making steady advances under Peter the Great and subsequently, now became the great opponent of Turkey. In the middle of the eighteenth century the Ottoman Empire still embraced a large part of Southern Russia. The victories of Catharine II's general Romanzov in the war between 1768 and 1774 determined the political superiority of Russia, and at the Peace of Kuchuk-Kainarji, in 1774, Abdul Hamid I (1773–89) renounced his sovereignty over the Crimea, yielded to Russia the country between the Bug and the Dnieper, with Kinburn and Azov, and agreed to open his seas to Russian merchant ships. By the Peace of Jassy (Roum. *Iaşi*), 1792, which closed the war of 1787–91, Russia retained Taurida and the country between the Bug and the Dniester, together with Otchakov, and gained some territory in the Caucasus. In the long series of wars which followed the French Revolution, the Ottoman Empire first found herself opposed to France, in consequence of Bonaparte's campaign in Egypt, and finally to Russia, who demanded a more distinct recognition of her protectorate over the Christians, and to whom, by the Peace of Bucharest (28th May, 1812), she ceded that part of Moldavia and Bessarabia which lies beyond the Pruth. In 1817 Mahmud II (1808–39) was obliged to give up the principal mouth of the Danube to Russia. Further disputes ended in the Porte making further concessions, which tended towards loosening the connection of Serbia, Moldavia, and Wallachia with Turkey. In 1821 broke out the War of Greek Independence. The remonstrances of Britain, France, and Russia against the cruelties with which the war against the Greeks was carried on proving of no avail, those Powers attacked and destroyed the fleet (Turco-Egyptian) of Mahmud at Navarino (1827). In 1826 the massacre of the Janissaries took place at Constantinople, after a revolt. In 1828–9 the Russians crossed the Balkans and took Adrianople, the war being terminated by the Peace of Adrianople (1829). In that year Turkey had to recognize the independence of Greece. In 1831–3 Mehemet Ali, nominally Pasha of Egypt, but real ruler of both Egypt and Syria, levied war against his sovereign, and was threatening Constantinople when Russia, who had been called on for aid by the Sultan, forced the invaders to desist. In 1840 Mehemet Ali again rose against his sovereign, but, through the active intervention of Great Britain, Austria, and Russia, was compelled to evacuate Syria, though he was, in recompense, recognized as hereditary Pasha of Egypt.

The next important event in the history of the Ottoman Empire was the war with Russia (1853) in which Turkey was joined by England and France. This war, known as the Crimean War (q.v.), terminated with the defeat of Russia, and the conclusion of a treaty at Paris (30th March, 1856) by which the influence of Russia in Turkey was greatly reduced. The principal articles were the abolition of the Russian protectorate over the Danubian principalities (Wallachia and Moldavia), united in 1861 as the Principality of Roumania), the rectification of the frontier between Russia and Turkey, and the cession of part of Bessarabia to the latter Power.

In 1875 the people of Herzegovina, unable to endure any longer the misgovernment of the Turks, broke into rebellion. A year later the Serbians and Montenegrins likewise took up arms, and though the former were unsuccessful and obliged to abandon the war, the Montenegrins still held out. Meantime the Great Powers of Europe were pressing reforms on Turkey, and at the end of 1876 a conference met at Constantinople with the view of making a fresh settlement of the relations between her and her Christian provinces. All the recommendations of the conference were, however, rejected by Turkey; and in April following, Russia, who had been coming more and more prominently forward as the champion of the oppressed provinces and had for months been massing troops on both the Asiatic and the European frontiers of Turkey, issued a warlike manifesto and commenced hostile operations in both parts of the Turkish Empire. She was immediately joined by Roumania, who (22nd May, 1877) declared her independence. The progress of the Russians was at first rapid; but the Turks offered an obstinate resistance. After the fall of Kars, however (18th Nov.), and the fall of Plevna (10th Dec.), the Turkish resistance completely collapsed, and on 3rd March, 1878, Turkey was compelled to agree to the Treaty of San Stefano, in which she accepted the terms of Russia. The provisions of this treaty were, however, considerably modified by the Treaty of Berlin concluded on 13th July, by which Roumania, Serbia, and Montenegro were declared independent; Roumanian Bessarabia was ceded to Russia; Austria was empowered to occupy Bosnia and Herzegovina; and Bulgaria was made a tributary principality.

In 1876 Abdul Hamid II succeeded to the throne, and in 1881 France occupied Tunis, while Great Britain took over Egypt to suppress disorders there. The Young Turk movement became gradually more active, and, in the belief that Abdul Hamid's despotic rule was the sole cause of Turkish humiliation by the Great Powers, the Young Turks organized the revolutionary movement which culminated in the violent political upheaval of July, 1908, when the Sultan was compelled to restore the 'Constitution of 1876', and the Committee of Union and Progress, with the army supporting it, became the real master of Turkey. Abdul Hamid was dethroned in April, 1909, and exiled to Salonika. He was succeeded by his brother, Reshad Effendi, as Mahommed V, and the Committee inaugurated a secret reign of terror, in course of which martial law was established, and a programme of compulsory Turkification in accordance with the Young Turk gospel of Turanianism was rigidly enforced. Their Pan-Turanian ideas were camouflaged by a brilliant display of Pan-Islamic ideals after the manner of Abdul Hamid, and this naturally aroused the antagonism of Great Britain, France, and Russia, while fostering the obvious friendship of the Committee with Germany and the Central Powers. Italy, in 1911, began to seize for herself what she considered to be her rightful share of the 'sick man's' potential legacy, and her troops landed in Tripoli and Cyrenaica. Peace was concluded by the Treaty of Lausanne, in which Italy agreed to surrender those islands of the Dodecanese occupied by her in return for free occupation of Tripoli; but the bargain never took effect. Meanwhile Montenegro declared war on Turkey (8th Oct., 1912), and on 17th Oct. Turkey declared war on Serbia and Bulgaria. Greece declared war on Turkey on the following day, and hostilities immediately began, lasting until 3rd Dec., when an armistice was signed and unsuccessful negotiations began. On 3rd Feb., 1913, the war was renewed, and was finally concluded on 30th May. This was a signal for discord among the victorious Balkan allies; the Bulgarians attacked the allied Serbo-Grecian army (29th June), but, with Montenegrin and Roumanian assistance, the Serbo-Greeks drove back the Bulgar forces. Enver Pasha had now come into prominence in Turkey, and he seized the opportunity to advance on Adrianople, and made so much political use of his military successes that Bulgaria was humbled. In the midst of her military reverses Turkey revealed the existence of what the Powers regarded as a secret military convention with Germany, when General Liman von Sanders took over command of the Dardanelles and Constantinople defences. In June, 1914, the *Goeben* visited Constantinople, and both Pan-Islamic and Pan-Turanian ambitions drove Turkey into the European War on the side of Germany and the Central Powers; and in the flames of battle that between 1914 and 1918 raged all over the world Ottoman Turkey was consumed. Only a few fragments remained of the Empire when the Treaty of Sèvres was forced upon the Turks in 1920, but the nucleus of Turkish power, Anatolia, remained practically unscathed; and the Turkish nation now began to exhibit that remarkable and entirely unlooked-for power of recovery in impossible circumstances that has characterized the race of Othman since its first appearance on the stage of authentic history. Ottoman Turkey disappeared, and from Aug., 1920, there began a period of internal reconstruction and organization that co-ordinated the new Turkish state into a military weapon, which by 1922–3 was powerful enough to humiliate the Great Powers.

Nationalist Turkey.—The formation of Nationalist Turkey was due to the occupation of Smyrna and Thrace by the Greeks, as a more or less natural consequence of the Anglo-Hellenic *rapprochement* fostered by Venizelos and Lloyd George. Until 1907 Great Britain had supported Abdul Hamid against the Tsar. A sudden change in British diplomacy and the Anglo-Russian Treaty (1907) precipitated the alarmed Young Turks into the Revolution of 1908, in a frantic but futile bid for British support. The reactionary schemes of Abdul Hamid caused his exchange from the magnificence of Yildiz Kiosk to the drabness of a Salonika dungeon (1909), and power was assumed by Enver Pasha. With the loss of British support the crash of the ramshackle Turkish Empire was inevitable, and Enver joined Germany in 1914 in a last frantic bid to save it. Mustafa Kemal was bitterly opposed to Enver; he forecasted the Turkish defeat and the Treaty of Sèvres. After the European War, Damad Ferid Pasha assumed power at Constantinople, and Kemal, dissatisfied with the disorder and maladministration of the country, went to Angora (1919) where he formed the nucleus of a powerful Nationalist party, which drew up a National Pact. In alarm, the British authorities deported to Malta as many known Nationalists as could be found, and a general exodus to Angora ensued, with the result that Kemal was enabled to form a stable Nationalist Parliament (Grand National Assembly), which adopted (23rd April, 1920) the National Pact in its entirety. Kemal had hoped that, Russia having dropped out, Great Britain might renew her understanding with Turkey; but it soon became obvious that the Treaty of 1907 had been replaced by Anglo-Hellenism, and, backed by the overwhelming might of the victorious arms of Britain, the Greeks occupied Smyrna. Kemal immediately scrapped the Mudros armistice; all Anatolia rallied round the Grand National Assembly, and a small force was raised which kept touch with the Greeks along the Bagdad Railway from Eskishehr to Afium-Karahissar; but, bottled up in Anatolia without a navy, Angora was quite unable to contest the Greek command of the coasts. A British military mission was attached to the Greek high command, and the scattered Turkish forces were defeated before Afium, all the key positions along the Bagdad Railway being taken. At this stage Kemal took command and fought the brilliant twenty-one days' battle of Sakaria (Sangarius), in which the Greeks failed to break through. In this battle Anglo-Hellenism and the Sèvres treaty (q.v.) became politically extinct, and France concluded a military and political alliance with Kemal. The French nation supported the Nationalist leader to the utmost; he received the guarantee of the entire credit of the French Republic; the war-ships of France and the liners of the Messageries Maritimes became Turkish transports, and the French arsenals toiled for Turkish freedom. All was now dependent upon time, and Kemal set to work to restore to its historic glory the military tradition of the Ottoman clan. The dawn of 26th Aug., 1922, heralded the Turkish offensive against Afium-Karahissar, and the Greek line collapsed; at 10 p.m. on 8th Sept. the Greek administration of Smyrna came to an end; the remnants of the magnificent Greek army, a quarter of a million strong, retreated in disorder, leaving half their number either captured or killed; General Tricoupis, the Greek Commander-in-Chief, was taken; Smyrna, the streets blocked by thousands of panic-stricken settlers from the surrounding country-side, and by demoralized soldiery, became a hotbed of typhus. Preceded by cavalry, the Nationalist troops entered Smyrna on 9th Sept., and took the Greek units remaining there. There was no disorder; the Turkish leaders saw that there was neither rioting nor looting. On 11th Sept. Mustafa Kemal entered the city in triumph. A meeting of the Allied generals and Kemalist representatives was held at Mudania on 3rd Oct., when the restoration to the Nationalists of Smyrna and all Anatolian territory, together with Thrace, was arranged. Subsequent conferences were held at Lausanne. See *Thrace.*—BIBLIOGRAPHY: *Annual Report* on the Trade and Economic Relations of Turkey (H. M.

Stationery Office); *Anatolia* (No. 59 in *Peace Handbooks*, vol. x, part i, of *Turkey in Asia*: H.M. Stationery Office), a general physical, economic, and historical survey; *Turkey in Asia* (No. 58, same series); *Armenia and Kurdistan* (No. 62), should also be consulted; Sir W. M. Ramsay, *Impressions of Turkey* and *The Historical Geography of Asia Minor*; Sir Edwin Pears, *Life of Abdul Hamid* and *Turkey and its People*; W. E. D. Allen, *The Turks in Europe*; Lord Eversley, *The Turkish Empire: its Growth and Decay*.

Literature.—With the adoption of Islam, the Turks adopted also the Arabic alphabet, and thus immediately after the conquest of Persia, fell under the sway of Persian literature. This influence lasted for more than 500 years, from about 1300 to about 1840. This is called the classical period, which is followed by the modern from 1840 onwards. The classical period can be divided into three phases: 1301–1520, where Persian influence is paramount, 1520–1730 the real classical period in which the most brilliant writers lived, and 1730–1840 the period of decay. No fewer than 2200 writers have been enumerated by Hammer-Purgstall, who has published abstracts from them all. Out of 34 sultans no fewer than 21 were poets, some of great eminence like Selim I (1512–20) and many of the high officials and dignitaries were also poets of renown.

The modern literature is a complete break with the past, influenced by the romantic movement of the West and falling under the spell of French literature. It emancipates itself wholly from the old tradition and the old forms, and the Persian and Arabic elements are discarded. The new writers and poets draw their inspiration overwhelmingly from French literature, although their vocabulary is pure Turkish. This literature serves also to awaken the national consciousness and effects a reinterpretation of Islam. Of the prominent leaders of the new movement are to be mentioned Namük Kemal (1837–88); Abdulhal Hamid (born 1852), romantic poet; Tewfik Fıkret (1868–1914), purely of the Western school; Zia Gök Alp (born 1875), nationalist poet; Mehmed Emin (born 1869), popular poet; Mehmed 'Akif (born 1872); and Shinasi (1859). Among anthologies are that of Kafsade (1622), containing abstracts of 514 writers; and Ebuz-Ziya Tewfik, prose, 1886.—Bibliography: Wells, *A Practical Grammar of the Turkish Language* (London, 1880); Kieffer and Bianchi, *Dictionnaire Turc-Français* (Paris, 1850); Hammer-Purgstall, *Geschichte d. osman. Dichtkunst* (4 vols., Pest, 1836–8); E. J. W. Gibbs, *History of Ottoman Poetry* (5 vols., 1900–8).

Turkey, a large gallinaceous bird (*Meleagris gallopavo*), well known as an inmate of our poultry-yards. It is a native of North America, and was introduced into Europe in the sixteenth century. Wild turkeys abound in some of the forests of America, where they feed on berries, fruits, insects, reptiles, &c., their plumage being a golden bronze, shot with violet and green, and banded with black. On account of its size and the excellence of its flesh and eggs, the turkey is one of the most valued kinds of poultry. There is another species, the Honduras or West Indian turkey (*Meleagris ocellata*), which derives its specific name from the presence of bright eye-like spots on the tail-coverts. It is not so large as the common turkey, but its plumage is more brilliant.

Turkey-buzzard, or Turkey Vulture, a rapacious bird belonging to the family of New World vultures (Cathartidæ) and the genus Cathartes (*C. aura*): so named from its bearing a distant resemblance to a turkey. It is about 2½ feet long, and with wings extended about 6 feet in breadth, general colour black or brownish, head and upper part of the neck scarlet. It inhabits a vast range of territory in the temperate and tropical parts of America. A closely allied species (*C. perniger*), native to the Amazon, is distinguished by its yellow head.

Turkey-red, a brilliant and durable red colour produced by madder (and now by alizarine) upon cotton cloth, and introduced from the East about the end of the eighteenth century. The processes used in turkey-red dyeing are numerous, and vary in different establishments, but the most essential is the preliminary treatment of the fabric with oils or fats, combined with certain other substances, such as carbonate of potash or soda. Turkey-red dyed yarns are usually introduced into striped linen cloths, as the colour is proof against ordinary bleaching processes.

Turkey-stone, a very fine-grained siliceous slate. When cut and polished it is used for sharpening small cutting instruments.

Turkmen. See *Turcoman.*

Turks and Caicos, a British archipelago of the West Indies, a political dependency of Jamaica. Grand Turk (6 miles long by 2 miles broad) is the chief island; pop. 1680. In the Caicos group Cockburn Harbour is the chief settlement. Throughout the archipelago the day temperature is 78° F. (mean), and the wet season lasts from October to February. There are occasional hurricanes, but the group is healthy. Steamships from New York to Santo Domingo call fortnightly at Grand Turk. Education is free and undenominational. The chief production is salt; some sponges from the Caicos Bank, dried conchs, and sea-shells are exported; cotton is grown. Trade is almost entirely with the United States, and all foodstuffs are imported. The people are of European and African extraction, and are all English-speaking. Until the end of the seventeenth century the archipelago was uninhabited, but was eventually visited by salt-rakers from Bermudas, who, with constant interference from the Spanish, carried on work for forty years. In 1799 the islands became a dependency of the Bahamas, but have been attached to Jamaica since 1848, although enjoying a certain measure of local government. See *Caicos*; *Jamaica*.

Turkwel, a river of Central Africa, rising in the crater-lake of Mount Elgon, and flowing over the floor of the Great (Eastern), Rift Valley towards Lake Rudolf, to the inland drainage system of which it belongs; but it does not reach the lake, and is lost in the sands half a mile from the western shore. Throughout its length the Turkwel forms the political frontier between Uganda and Kenya Colony. It receives the drainage of the Karamojo Plateau, and partly of the Sua Mountains (Kenya), and Mount Debasien (a horst, 10,050 feet altitude). The Kerut or Wei-Wei River is its only substantial tributary, and for 60 miles below the confluence the breadth of the combined stream varies between 500 and 600 yards.

Turmeric, the dried tubers or rhizomes of *Curcŭma longa*, nat. ord. Zingiberaceæ (ginger). It is largely employed in India and China as an important ingredient in curry powder. Unsized white paper, steeped in an alcoholic solution of turmeric, when dried, is employed as a test to detect alkalies, which change its colour from yellow to reddish-brown. Turmeric yields a yellow colour, which has great brightness but little durability. It is also used medicinally in the East as a carminative.

Turner, Joseph Mallord William, English landscape-painter, was born in London 1775, died there 1851. The son of a hairdresser, he was first apprenticed to Thomas Malton, the architectural and topographical draughtsman; and was also one of the group of young artists who copied from the drawings in Dr. Monro's collection. In 1789 he entered the Royal Academy as a student, and remained there for five years. He first exhibited at the Academy in 1792, and was elected in 1799 an associate of the Royal Academy, and in 1802 a full Academician. Till this date he had chiefly been known as a landscape-painter in water-colours, but thenceforth he turned his attention to oil-painting, and in the ensuing half-century produced at the Academy exhibitions upwards of 200 pictures. In 1807 he was elected professor of perspective in the Royal Academy, and the following year appeared his *Liber Studiorum* (Book of Studies), a series of engravings in mezzotint and etching inspired by Claude's *Liber Veritatis*. Among other works by him which were engraved are his illustrations of Lord Byron's and Sir Walter Scott's poems, Rogers's *Italy* and *Poems*, *The Rivers of England*, *The Rivers of France*, and *Scenery of the Southern Coast*. Up to about 1810 Turner's work was marked by great precision in execution and rather sombre colour, reflecting the influence of the Dutch landscape-painters and of the Poussins. Examples are: *The Windmill and Lock* (1806), *The Garden of the Hesperides* (1806), and *The Sun rising in Mist*. After 1810, under the influence of Claude, he showed the broader handling and greater atmospheric quality seen in *Hannibal crossing the Alps* (1812), *Apuleia in search of Apuleius* (1814), and *Crossing the Brook* (1815). In 1819 a visit to Italy marks the beginning of a third phase, distinguished by imaginative quality, freedom in handling, and richer colour, and represented by *The Bay of Baiæ*, *Early Morning* (1826), *Dido* (1828), and *Ulysses deriding Polyphemus* (1829). A second visit to Italy in 1828 assisted towards the development of the richer colour of a fourth phase, and in 1839 *The Fighting Téméraire* inaugurated the final style, where Turner gives free rein to his imagination, and paints little but such visions in terms of light as *The Sun of Venice going to Sea* (1843), *Petworth*, and *Rain, Steam, and Speed* (1844). By his will he bequeathed all his pictures and sketches to the nation, on condition of a suitable building being erected within ten years for their reception. A certain number are now in the National Gallery, the remainder being at the Tate Gallery. Turner's influence on landscape-painting has been very considerable. In particular, he contributed to the development of the Impressionist school in France.

Turnhout, a town of Belgium, in the province of Antwerp. It has manufactures of linen, woollen, and cotton fabrics, coloured paper, playing-cards, and liquor. Pop. 23,067.

Turning. See *Machine Tools*.

Turnip, the common name of the *Brassica Rapa*, a cruciferous, biennial plant, much cultivated on account of its esculent root, and of the same genus as the cabbage, cauliflower, and broccoli. The turnip, as a culinary vegetable and as a cattle food, was well known to the Greeks and Romans, the latter of whom may have introduced it into gardens in Britain, though a wild variety or species (*B. campestris*) is found there. The root is generally used as a culinary vegetable in all temperate climates, and in Britain particularly the vegetable is cultivated on a large scale for feeding stock, the root being invaluable for this purpose. In the field culture of the larger-rooted varieties the most advantageous mode is by drills. The plant thrives best on a rich and free soil and in moist cloudy weather. There are several varieties, all apparently the result of cultivation. The Swedish turnip, which forms a valuable field crop, is probably a distinct species. *B. Napus* yields rape, cole, or colza seeds, from which a well-known fixed oil is expressed.

Turnstone, a bird of the plover family (*Strepsilas interpres*). The length of the bird is about 9 inches. It takes its name from its practice of turning up small stones in search of the marine worms, minute crustaceans, &c., on which it feeds. It breeds in Northern Europe, Asia, and America, and occurs in Britain as a winter visitant.

Turnu-Magurele, a Danube port of Roumania, capital of the department of Teleorman, 372 miles above Sulina, at the confluence of the Alt (Roum. *Oltu*) with the main stream; served by branch line to Costeţi on the Wallachian Railway. It is opposite, and has ferry connection with, the Bulgarian fortress of Nikopol, and it makes grain shipments to Brăila. Industries include the manufacture of furniture, bricks, linen, aerated-water, and agricultural implements. Pop. 18,000. The department of Teleorman has an area of 1810 sq. miles; pop. 310,000.

Turnu-Severin, a Danube port of Roumania, capital of the department of Mehedinţi, 580 miles above Sulina; served by the Wallachian Railway (Craiova - Varciorova - Temisoara). It has railway repair-shops and government ship-building-yards, where most of the Roumanian river vessels are made and repaired. At the abattoirs animals are slaughtered mainly for export to Central European countries. Cattle, preserved meat, cereals, petroleum, and leather are traded; the town is the seat of the Roumanian Customs House. Pop. 24,000. The department of Mehedinţi has an area of 1910 sq. miles; pop. 300,000.

Tur′pentine is a balsam obtained from various coniferæ by cutting the stems and collecting the sticky exudation. On distillation either with direct heat or with steam 'oil of turpentine' passes over and a residue of colophony or common resin is left behind. American, French, and Venice oil of turpentine form the most important commercial varieties, and are obtained from various species of pine. They differ mainly in their behaviour towards polarized light. Oil of turpentine is a colourless liquid with a pleasant odour, boiling-point about 160° C., specific gravity between 0·85 and 0·87. On exposure to air it becomes viscous and partly resinified. The chief ingredient is a terpene, known as pinene ($C_{10}H_{16}$). It is an excellent solvent for phosphorus, sulphur, iodine, &c., and also for resins; for this reason it is largely used in the preparation of paints and varnishes. In medicine it is applied externally as a counter-irritant, but when inhaled or taken internally in large doses it is injurious. For certain purposes the commercial oil of turpentine is rectified by treatment with slaked lime and distillation with steam.

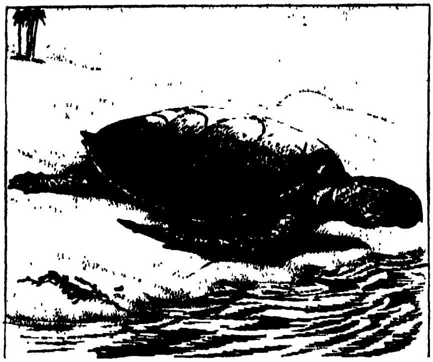
Turpentine Tree, the name given to some species of trees of the genus Pistacia, nat. ord. Anacardiaceæ, which yield turpentine, as the *P. Terebinthus*, the Chian or Cyprus turpentine tree, *P. lentiscus*, the Mount Atlas mastic or turpentine tree, &c. See *Pistachio*.

Turpin, Dick, English robber, was born at Hempstead, in Essex, in 1706, and was hanged at York in 1739. He was apprenticed to a butcher, but joined a gang of deer-stealers and smugglers. The gang frequently attacked lonely farm-houses and tortured the inhabitants. In 1735 Turpin stole a horse in Epping Forest, and was traced to Whitechapel. He was on the point of being arrested when he accidentally shot his partner King and fled to Yorkshire, where he set up as a cattle-dealer. He was executed for horse-stealing.

Turpin was a commonplace scoundrel; there was no romance and much villainy in his actual career. He owes his celebrity to Harrison Ainsworth, who immortalized him in *Rookwood* (published 1834). This romance gives an account of his ride to York, on his mare Black Bess, undertaken in order to prove an alibi. The legend of this ride has sometimes been connected with the highwayman John Nevison (hanged 1684), but it may be older still. At any rate, the story of Dick Turpin's ride was not extant until ninety-five years after he was hanged. Since 1834 numerous chap-books on the subject have appeared.

Turquoise (tur′koiz), a greenish-blue opaque precious stone, consisting essentially of a hydrous phosphate of alumina, containing a little oxide of iron and oxide of copper. The true or Oriental turquoise, a favourite ornamental stone in rings and other articles of jewellery, is found only in a mountain region of Persia, and was originally brought into Western Europe by way of Turkey (hence the name).

Turtle, the name given to the marine members of the order Chelonia, reptiles with paddle-like limbs, and differing but little from tortoises, the name turtle or tortoise being in some cases applied indifferently. They are found in all the seas of warm climates. The most important species is the green turtle (*Chelone mydas*), which is from 6 to 7 feet long, and weighs from 700 to 800 lb. The food mostly consists of marine plants. Its flesh is highly esteemed as a table luxury. It is a native of the tropical parts of the Atlantic as well as of the Indian Ocean, being especially abundant near Ascension Island. The carnivorous logger-head turtle (*C. caretta*) yields an oil, which is used for lamps and for dressing leather. The hawk's-bill turtle (*C. imbricāta*), another carnivorous species, is remarkable for the beautiful imbricated horny plates covering the carapace, and constituting the tortoise-shell of commerce. A large one yields as much as 8 lb. See *Tortoise.*



Hawk's-bill Turtle (*Chelone imbricāta*)

Turtle-dove (*Turtur commūnis*), a small variety of pigeon, about 11 inches in length, colour pale-brown marked with a darker hue above, a purple tinge pervading the feathers of the breast. They are in general smaller and more slender than the domesticated pigeons, and their cooing note is plaintive and tender. Turtle-doves winter in Northern Africa and Western Asia, migrating to Europe (including Britain) late in April.

Turton, an urban district and town of Lancashire, England. There are cotton-mills, paper-factories, print-works, bleach-works, &c., and power and water is supplied from Bolton. Pop. 12,200.

Turtucaia, or **Tutrakan**, a town of Roumania, in the Dobruja, on the Danube. It is a Danube fishing-centre, and has a trade in cereals. Turtucaia has figured much in history, especially during 1912-3 (London Congress and Treaty of Bucharest), and during the European War, when (6th Sept., 1916) it was occupied by the left wing of the Bulgarian army six days after the entry of Roumania into the war. Pop. 10,100.

Tuscaloosa, a city of Alabama, United States, the county seat of Tuscaloosa county, on Black Warrior River; served by the Mobile & Ohio, and the Alabama Great Southern Railways. It is an educational centre, with the University of Alabama (founded 1820), and several colleges, and the adjacent district is engaged in coal and iron industries. Founded in 1815, Tuscaloosa became a city in 1819, and was state capital (for twenty years) until 1846. Pop. 12,000.

Tuscan Order of Architecture, one of the five orders of architecture, according to Vitruvius and Palladio. It admits of no ornaments, and the columns are never fluted. Otherwise it differs so little, however, from the Doric, that it is generally regarded as being only a variety of the latter. See *Doric Order.*

Tus'cany (It. *Toscana*), a maritime compartimento of North-Western Italy, comprising the provinces of Arezzo, Firenze, Grosseto, Livorno, Lucca, Massa e Carrara, Pisa, and Siena; area, 9302 sq. miles; pop. 2,800,000. It is traversed north and east by the main range and by spurs of the Etruscan Apennines, and is generally hilly. The Arno is the chief river, and the Arno Valley with its peneplanes forms the richest agricultural region of Tuscany. Cereals, wine (*Chianti*), tobacco, oil, chestnuts, and flowers are produced, and horses and cattle are grazed on the coastal plain (Maremma). The Maremma (850 sq. miles) was at one time a malarial death-trap. The wealth of Tuscany lies in its minerals, which include lignite, alabaster, marble, iron, mercury, copper, and salt. There are springs (mineral and hot) at Montecatini and Bagni di Lucca. Florence is the chief town, Leghorn the chief seaport, and Florence, Pisa, and Siena are art centres.

Tuscany corresponds to the ancient *Etruria* (q.v.), which was, however, of wider extent. After the fall of the Western Empire (A.D. 476) it passed successively into the hands of the Ostrogoths, Byzantine Greeks, and Lombards. Charlemagne made it a Frankish province, and it was governed by marquesses or dukes until the twelfth and thirteenth centuries, when it became broken up into a number of small republics, four of which were Florence, Pisa, Siena, and Lucca. From the first Florence occupied the leading place, and it gradually extended its territory. Dante, Giotto, Petrarch, and Boccaccio made Tuscany famous in the revival of arts and letters in the fourteenth century, and the Tuscan dialect became the literary language of Italy. In 1569 Pope Pius I granted to Cosmo I the title of Grand-Duke of Tuscany, and this position was retained, with interruptions, by the Medici family until 1737, when it passed to Francis Stephen, duc de Lorraine. In 1859, when under his descendant, the Grand-Duke Leopold, it was annexed to Sardinia by a popular vote, and in 1861 became, with Sardinia, part of the Kingdom of Italy.

Tus'culum, an ancient city of Latium, of which the ruins are found about 1¼ miles north-east of modern Frascati (Italy) and 15 miles south-east of Rome. It stands among the Alban Hills at an altitude of about 2000 feet, and is traditionally older than Rome itself, having been founded by Telegonus, son of Odysseus and Circe. In the time of Tarquinius Superbus, Octavius Mamilius of Tusculum married Tarquin's daughter, and the alliance of Mamilius with Tarquin was the main cause of the Latin War, during which Mamilius was killed. Towards the end of the Republic, Tusculum was one of the favourite resorts of wealthy Romans, but, unlike *Tibur*, it did not apparently appeal to the poets. In form the city comprised a lower region or town, dominated by an isolated arx or citadel, which towered on the topmost peak above. Tusculum was the birth-place of the elder Cato.

Tussac, or **Tussock-grass** (*Dacty̆lis cæspitōsa*), a large grass, of the same genus as the cock's-foot grass of Britain, a native of the Falkland Islands, Fuegia, and South Patagonia. It grows in great tufts or tussocks sometimes 5 or 6 feet in height, the long tapering leaves hanging over in graceful curves. The plant is a useful food for cattle, and several attempts have been made to establish it in Scotland.

Tussore, a fabric probably first made from Tussah silk which is obtained from the cocoons of the Tussah (Tusser) moth. These fabrics, however, are now mostly made from mercerized cotton yarns. *Shantung* is a similar, comparatively rough-surfaced cloth, still made in China and India, but frequently imitated.

Tutankhamen, one of the last three kings of the XVIIIth dynasty of ancient Egypt. He gained his title to the throne by marrying the third daughter of Akhenaten, whose second daughter had died at birth, and whose eldest daughter had married Sakere (see *Tell al-Amarna*). Tutankhamen succeeded Sakere. The royal marriages of ancient Egypt were contracted by both parties at an early age, and Ankhesenamen seems to have married Tutankhamen when she was only twelve years of age. Kings, it is thought, came of age at sixteen, but experts disagree regarding the actual age of Tutankhamen at his accession. His tomb in the Valley of the Kings was discovered by Lord Carnarvon and Mr. Howard Carter, and was officially opened on 29th Nov., 1922; but among the contents there appears to have been nothing whatever that would indicate the king's manhood. All of the articles found, including a magnificent painted wooden mannikin in the king's likeness, and used as a sort of tailor's dummy, point to the fact that Tutankhamen at his death was a mere boy. If this be granted, the religious changes effected during his short reign become extraordinary. The fine throne or chair of State bears in only one place his early title Tutankhaten. Elsewhere 'Tutankhamen' is the rule. The actual entrance to the tomb of Tutankhamen was discovered on 5th Nov., 1922, and the tomb itself consists of an antechamber approached by two short flights of stairs. On the right of the antechamber is the door of the shrine or inner chamber, which was guarded by two large statues. This chamber was first opened on 16th Feb., 1923. The tomb of Tutankhamen was the first tomb of an Egyptian king to be discovered intact, and its small size bears silent witness to the troubles of his reign and to his premature death.

Tutbury, a town of Staffordshire, England, on the Dove, 4 miles north-west of Burton-upon-Trent. It has ruins of a Norman castle, in which Mary Queen of Scots was imprisoned. Pop. 2000.

Tuticorin′, a seaport-town of Madras province, India, in Tinnevelly district; the southern terminus of the South Indian Railway, and the centre of a large passenger traffic with Ceylon. It is an important commercial city, ranking second in the province and among the first ten in all India. Pop. 34,760.

Tutor, (1) at Oxford, Cambridge, and Dublin, a graduate (almost invariably a Fellow of his college), to whom the special supervision of an undergraduate is assigned. At Oxford a tutor's main duty is to look after his pupils' studies; at Cambridge he is more concerned with the social and economic welfare of his pupils. (2) In Scots law, the guardian of a boy or girl in pupilarity. By common law a father is tutor to his children. Failing him there may be three kinds of tutor, a *tutor-nominate*, a *tutor-at-law*, or a *tutor-dative*.

Tuttlingen, a town of Württemberg, on the Danube. It manufactures surgical and scientific instruments, leather goods, woollens, and beer. Pop. 15,860.

Tver, a government of Central Russia. It has an area of 25,000 sq. miles, and a population of 2,250,000. Rye, barley, hemp, and flax are produced, and the forests are extensive.

Tver, a city of Central Russia, capital of the government of Tver, situated in a plain on the Volga, 96 miles north-west of Moscow. Manufactures are mainly confined to cottons. Dating from 1181, Tver was the capital of an independent principality from the thirteenth century to the end of the fifteenth. Pop. 62,600.

Tweed, a river of Scotland, which rises in the south part of Peeblesshire, passes by or near to Peebles, Melrose, Kelso, and Coldstream, from near which place it forms the boundary line between England and Scotland for 16 miles, runs through England for a short distance, and then enters the North Sea at Berwick-on-Tweed; total length, 97 miles. Its tributaries include the Ettrick, Gala, Leader, Teviot, Eden, and Till. Its waters abound with salmon and trout, and its name is celebrated in connection with some of the best literature of Scotland.

Tweedmouth, a town of Northumberland, England, on the south bank of the Tweed, near its mouth, opposite Berwick-on-Tweed. Pop. 5160.

Tweeds, or **Tweed**, in reference to textiles, is the name applied exclusively to woollen goods which are made from multi-coloured materials. The various colours constituting the fabric may be due to the admixture of several differently coloured wool-dyed fibres with some body colour, to yarns of different colours twisted together, or to two or more self-coloured yarns arranged in some predetermined order in the warp, in the weft, or in both, so as to form a pattern. It should be remarked that the pattern owes as much of its actual effect to the colour scheme of the threads as to the weave employed. The etymology of the word *tweed* is doubtful; but since practically all so-called tweeds are woven by twill weaves, and since the Scottish equivalent in some districts for twill is tweel,[1] it seems quite likely that the word tweed, as applied to fabrics, owes its origin to a badly formed 'l' in the word tweel. The word twill simply means that the simple directional ornament formed by the intersecting of the warp and weft yarns runs diagonally, and usually at about 45°, from selvage to selvage of the cloth. Originally, real tweeds were made of yarns composed of wool and wool alone, but the term is now a little more elastic, for a considerable number of so-called tweeds are made wholly or partially from remanufactured products such as waste, mungo, and shoddy. A real Scotch tweed, however, should be, and probably always is, made from pure wool, and so are the Harris tweeds and many of the Yorkshire and other tweeds. The admixture of colours to black and white bases, including all shades of grey, and of different kinds of fibres, has become a fine art, and considerable difficulty is experienced in detecting any type of adulteration (unless such adulteration is excessive) except by scientific analysis. Indeed, one is often advised to choose his colours and trust his tailor for the rest. The chief use for tweeds was, for some time, for men's suits; their use has now been extended to mid-weight overcoats, to several types of garments for ladies, and to sports suits. They are also found adapted for the lighter kinds of travelling-rugs and for several types of decorative textures.

Twelfth-day, the twelfth day after Christmas, upon which is held the festival of Epiphany (q.v.). On the evening of this day, called Twelfth-night, various social rites and ceremonies are, or were, observed in different countries. One of these is the baking of a twelfth-cake, into which a bean is introduced. When the cake is divided at the feast, the person who receives the piece containing the bean is made king for the occasion. In Italy it is customary to give presents to children on this day.

Twickenham, an urban district and residential suburb of Greater London, in the county of Middlesex and on the Thames. In last century it was a fashionable resort, and has numbered among its residents Queen Anne, Horace Walpole, Charles Dickens, Tennyson, and Alexander Pope. Pop. 34,800.

Twilight, daylight which continues after sunset, occasioned by the reflection of sunlight from the higher parts of the atmosphere which are still illuminated after the sun has become invisible from ordinary heights. It is supposed to last till the sun is about 18° below the horizon, but is much influenced by the state of the atmosphere as to clouds, &c. There is also twilight for a similar period in the morning, generally called *dawn*. In this country twilight lasts in winter for about two hours before sunrise and after sunset. In summer there is all-night twilight during two or three months in Scotland. Near the equator twilight is of short duration the whole year round, owing to the steep angle at which the sun's diurnal path crosses the horizon.

Twill, a technical term indicating the method of interlacing the warp with the weft in a textile fabric. There are hundreds of different kinds of twill fabrics, each of which can be represented in a simple manner. Thus one of the commonest twills is the 2 up, 2 down twill, and this may be symbolically represented by $^{2}{}_{2}$. Similarly a 4-leaf weft swansdown, 1 up and 3 down, is denoted by $^{1}{}_{3}$, while the symbol $^{2}{}_{4}{}^{1}{}_{5}$ means a fancy twill repeating on 12 threads or picks with 2 up, 4 down, 1 up, 5 down, and so on.

Twiss, Sir Travers, British jurist, born in Westminster in 1810, died in 1897. Educated at University College, Oxford, he became a Fellow and tutor of his college; was appointed successively professor of political economy at Oxford (1842–9); professor of international law, King's College, London (1852–5); professor of civil law in Oxford (1855–70); and Advocate-General of the Crown (1867–72). He wrote many books dealing with international law and kindred topics.

Tyburn, a turnpike at the west end of Oxford Street, London, noted for the public executions of metropolitan malefactors which long took place near it. The turnpike was removed in 1829.

Tyldesley, an urban district and town of Lancashire, England. Its chief industries are cotton-spinning and coal-mining. Pop. 15,600.

Tyler, Wat, English rebel, and principal leader of the English social revolt of 1381. He was a man of obscure origin, but he is supposed to have come either from Kent or Colchester in Essex. He led the men of Kent upon London, where, after fire and pillage, they were partly dispersed by a promise of the king to grant them charters of freedom and amnesty. Tyler, however, remained with a body of the insurgents, and was met by the king next day at Smithfield, where, for his apparent insolence in the royal presence, he was stabbed by William Walworth, Mayor of London.—Cf. Sir Charles Oman, *The Great Revolt of 1381.*

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[1] In *Guy Mannering*, when "Captain Brown" asked Mrs. Dinmont for "just such a grey plaid as the goodman wears", he was promised "as gude a tweel as ever cam aff a pirn" (chap. xxvi).

Tylor, Sir Edward Burnett, British anthropologist, born at Camberwell 1832, died 1917. He devoted himself with much success to researches in the history of man and civilization; was president of the Anthropological Society, keeper of the Oxford University Museum, and reader in anthropology. First Gifford lecturer at Aberdeen in 1888, he was appointed professor of anthropology at Oxford in 1896. He was made F.R.S. in 1871, and was knighted in 1912. His chief works are: *Researches into the Early History of Mankind, Primitive Culture, Anthropology: an Introduction to the Study of Man and Civilization,* &c.

Tyndale, William, English translator of the Bible, born about 1490 in Gloucestershire, died in 1536. Educated at Oxford, he took orders and went as a tutor to Gloucestershire, where, in consequence of his opinions in favour of the Reformation doctrines, he was reprimanded by the chancellor of the diocese. He then removed to London, where he probably began his English version of the New Testament, and subsequently proceeded to Germany, visiting Luther at Wittenberg. Having completed his translation, he got it partly printed in quarto at Cologne; but he had to flee from this town, and the complete work was printed in octavo at Worms. The greater part was sent to England, and the prelates Warham and Tunstall collected all copies they could seize or purchase, and committed them to the flames. The only fragment of the quarto edition known to exist is preserved in the British Museum. Of the first octavo edition only two copies remain, one in the Baptist College at Bristol, the other (imperfect) in the library of the Chapter of St. Paul's. Revised editions were soon issued by Tyndale himself. Tyndale also translated the *Pentateuch,* and subsequently *Jonah.* In 1530 he took up his residence at Antwerp. In 1535 he was thrown into prison at Vilvorde, near Brussels, and being found guilty of heresy, he was strangled and his body burned at the stake. Tyndale's translation of the Scripture is distinguished by its perspicuity and noble simplicity of idiom.—Cf. G. B. Smith, *William Tyndale and his Translation of the English Bible.*

Tyndall, John, British physicist, born in 1820 in County Carlow, Ireland, died 1893. He joined the Irish Ordnance Survey in 1839, and was transferred to the English Survey in 1842. In 1847 he was appointed teacher in Queenwood College, Hants, then went abroad, where he studied under Bunsen in Marburg University and Magnus in Berlin. He was elected to the chair of natural philosophy in the Royal Institution in 1853; visited Switzerland in 1856 along with Huxley, and made repeated investigations in that country subsequently. He lectured throughout the United States in 1872, presided over the British Association in 1874 at Belfast, and was for several years adviser on lighthouses to the Board of Trade. His chief works are: *The Glaciers of the Alps* (1860); *Mountaineering in 1861* (1862); *Heat considered as a Mode of Motion* (1863); *On Radiation* (1865); *Sound* (1865); *Faraday as a Discoverer* (1868); *Light* (1870); *Researches on Diamagnetism and Magne-Crystallic Action* (1870); *Hours of Exercise in the Alps* (1871); *The Forms of Water in Clouds, Rivers, Ice, and Glaciers* (1872); *Fragments of Science* (1876); *Fermentation* (1877); and *Floating Matter in the Air in Relation to Putrefaction and Infection* (1881).

Tyne, a river of England, formed by the junction near Hexham of the North Tyne, which rises in the Cheviots, on the borders of Roxburgh, and the South Tyne, which rises at Tynehead Fell, in the extreme east of Cumberland. The united stream divides the counties of Durham and Northumberland, passes the ports of Newcastle, Jarrow, and North and South Shields, and enters the sea at Tynemouth after a course from Hexham of nearly 30 miles. From the sea to Scotswood suspension-bridge, a distance of about 10 miles, the river is navigable for large vessels; the trade on the river, chiefly in coal, is immense; and the whole of the Lower Tyne Valley is a busy industrial region.—Cf. A. J. Sargent, *The Tyne* (*Geographical Journal,* vol. xl (1912), pp. 469–86, with maps, &c.).

Tynemouth, a municipal borough and port of England, in the county of Northumberland, at the mouth of the Tyne. There are ruins of a picturesque old priory, an aquarium, winter-garden, baths, &c., and the place is much frequented for sea-bathing. The port of North Shields and several villages are included within the borough, which returns one member to Parliament. Pop. (1921), 63,786.

Type, a small rectangular block, usually of metal or wood, having on its upper end a raised letter, figure, punctuation mark, or other character, for use in printing (q.v.). Large types for posters are cut from close-grained wood like that of the box or maple. Types for book and newspaper printing are made from an alloy of melted lead, tin, antimony, and sometimes copper, that fills the mould exactly and shrinks but little in cooling. The beauty of text-types being in their precision, the letters on the steel punches from which types are cast must be uniform in style—height, line, stroke, serif, curve, and angle; they should be in proper relative proportion as to size, and as to nearness and distance in all combinations. William Caslon (1692–1766), the great English type-founder, was very successful in observing these conditions. In France Pierre Simon Fournier (1712–68) rendered a great service to typography by the invention of the system of 'typographic points', for determining the sizes and proportions of types. F. A. Didot (1730–1804) perfected this system. In Britain the old names given below are now falling into disuse, owing to the success of mechanical type-setting machines which have adopted the point system, 1 point being about the seventy-second part of an inch.

Point Sizes.	Old Names.	Actual Size of Letters.
4-point	(Brilliant)	The New Gresham Encyclopedia
4½-point	(Diamond)	The New Gresham Encyclopedia
5-point	(Pearl)	The New Gresham Encyclop
5½-point	(Ruby)	The New Gresham Encycl
6-point	(Nonpareil)	The New Gresham Ency
7-point	(Minion)	The New Gresham En
8-point	(Brevier)	The New Gresham E
9-point	(Bourgeois)	The New Gresham
10-point	(Long-primer)	The New Gresha
11-point	(Small-pica)	The New Gresh
12-point	(Pica)	The New Gres
14-point	(English)	The New Gr
18-point	(Great-primer)	The New

The body of this Encyclopedia is in roman face 8-point, upon a 9-point body to give a slight space between each line; *italic* is used for names of books, section headings, &c.; the word Bibliography is in small capitals; the titles of the articles are in **bold-face**, with the key-words at the top of the pages in large capitals; the notes are in 6-point.

The assortment of characters known as a fount of roman book-type requires the engraving of 150 punches:

28 large capitals, including Æ and Œ;
28 small capitals, including Æ and Œ;
33 lower-case characters, including fi, fl, ff, ffi, ffl, æ, and œ;
19 figures and fractions;
22 points, references, and signs;
20 other characters.

It is not desirable in good printing to mix the styles of type used in a book, but with the italic of the series the compositor can make use of six variations in each size, as thus:

ROMAN CAPITALS. *ITALIC CAPITALS.*

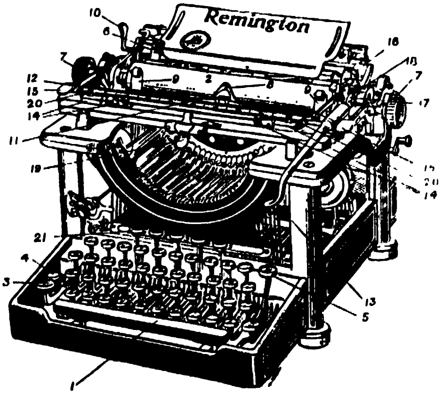
Roman Capitals and Small Capitals.

ROMAN SMALL CAPITALS.

Roman lower-case. *Italic lower-case.*

—Bibliography: T. L. De Vinne, *Plain Printing Types*; D. B. Updike, *Printing Types* (2 vols.).

Typewriter, a machine which writes characters similar to those produced by printers' types. The first practical typewriter was made, from a patent by C. L. Sholes, by Messrs. E. Remington & Son, Ilion, New York, in 1873. The paper is clamped to a cylinder, mounted on a sliding carriage, which can be moved to any horizontal position. When the typist releases a key the carriage moves to the left a distance equal to the breadth of a letter. An alarm bell is automatically rung when nearing the edge of the paper or any prearranged stopping place. The cylinder is rotated by a lever to give the desired spacing between each line, and adjustable stops are provided to govern the lever action. The inking ribbon is carried on two spools, and is automatically unwound and wound until the ink is removed by the types. The ribbon is placed between the type and the paper, and when the keys are depressed the characters, by means of a combination of jointed levers, transfer the ink to the paper. Each key is marked with the character it represents and carries two forms of the character, e.g. a capital and a lower-case letter. To move the paper under the desired form a shift key is provided at each side of the keyboard. The levers carrying the types radiate from a central point called the writing point.



Typewriter

1, Space key. 2, Shifting cylinder. 3, Shift key. 4, Shift lock. 5, Back spacer key. 6, Paper size guide. 7, Thumb wheel. 8, Line gauge. 9, Paper guide. 10, Feed-roll release key. 11, Pointer. 12, Carriage scale 13, Line space lever. 14, Marginal stop. 15, Carriage release lever. 16, Line space gauge. 17, Ratchet. 18, Variable line space lock. 19, Marginal release. 20, Final stop release lever. 21, Column selector key.

Typha'ceæ, a natural order of monocotyledonous plants, characterized by their calyx being three-sepalled and half-glumaceous, or a mere bundle of long hairs, by their long lax filaments, clavate anthers, solitary pendulous ovules, and peculiar habit. The order includes two genera, Typha and Sparganium, the species of which are abundant in the northern parts of the world. They are herbaceous reed-like plants, growing in marshes and ditches. See *Reedmace*.

Typhlops, the type genus of a family (Typhlopidæ) of blind burrowing snakes that feed on insects. They are tropical and subtropical forms with a wide distribution. *T. vermicularis* is native to the Balkan Peninsula and South-West Asia.

Typhoid Fever. See *Enteric Fever*.

Typhoon′, a name applied to tropical cyclones in the China Sea. They originate generally south of 10° N. lat., and are seldom encountered north of 50° N. lat. Taking origin east of the Philippines (where they are known as *baguios*), they shape a west-north-west course, sweeping the coasts of the China Sea, and then being deflected north-east to Japan, &c. In the centre or eye of the storm there is an absolute calm, and it is this death-trap that mariners must study to avoid. In the eye the barometric pressure is at its nadir, and overhead there is a patch of clear blue sky. Typhoons occur mostly during the change of monsoon, and between June and November, although September is the most prevalent month.

Etymologists differ in some respects regarding the etymology of the word typhoon. The German term is *teifun*, and is derived from the Chinese *tai fung*, meaning literally big wind. According to Murray, the English word is derived from the Urdū *tūfān*, a violent storm of wind and rain, and may represent the Greek *typhon*, which is the earlier English designation of these storms.

Typhus Fever (also called exanthematic typhus, jail, camp, or ship fever) is an acute infectious disease, characterized by a spotted rash, extreme physical prostration, and marked mental confusion. It is now rarely seen in Great Britain, and it may fairly be claimed that it has been stamped out by modern sanitation. This has been brought about by improvement of dwelling-houses, opening up congested areas, destruction of slum property, and the compulsory notification of infectious diseases. The disease is still common in Eastern Europe, and in the East, and is from time to time imported to Western countries by immigrants. It became more widespread during the European War (1914–8), and is still epidemic in wide districts in East Europe. Epidemics occurred in Arabia and Mesopotamia during the war. The disease is always associated with overcrowding, insufficient air-space, dirt, and destitution. The onset of the disease is very sudden, beginning with severe headache and well-marked chilliness, while vomiting and nausea occur in most cases. As the temperature rises the usual symptoms of fever appear, but the mental acuteness of the patient is blunted in a marked manner from the onset, and his appearance, with congested face, stupid expression, pink and watery eyes, is most suggestive. Prostration is a marked feature from the outset. By the fourth day of the disease the rash appears, and there is a distinctive and very unpleasant odour from the patient, which is compared to the smell of mice. The fever lasts for about a fortnight, and ends by a crisis of two to three days duration, followed by a lessening in severity of all the symptoms, with resulting convalescence and recovery; or during the fortnight, usually in the second week, the symptoms become more severe, with delirium, and the patient dies.

Treatment rests with good and careful nursing; special care is directed to the dangers of exhaustion and the effects of the delirium. Isolation of the patient and of contacts is necessary to prevent the spread of the disease. The chances of recovery in children are greater than in adults, and it is extremely fatal in old age.

Typography. See *Printing* and *Type*.

Tyr (Ice. *Týr*, etymologically connected with Gr. *Zeus*, and Lat. *deus*), the Scandinavian name of a one-armed Teutonic deity, represented in the *Eddas* as the son of Odin, and god of war. He was the bravest of the gods, and lost his arm by placing it in the mouth of the wolf *Fenrir* as a hostage, while being tied up by an unbreakable cord. Tyr is called *Tiw* in Anglo-Saxon, whence *Tiwes daeg*, or Tuesday.

Tyran′nus, the type-genus of an American family (Tyrannidæ) of perching birds. The best-known species is the king bird (*T. carolinensis*), which is remarkable for its bold and pugnacious disposition. It is a native of the United States, feeds on insects, and is not afraid to attack birds of prey much larger than itself. It is also called *tyrant-shrike*.

Tyrant, a word derived from the Gr. *tyrannos*, which signified an absolute ruler. The word did not have originally the bad signification which we now attach to it; but as it is a general rule that the possessor of uncontrolled power, whether individual, corporation, or multitude, will abuse it, *tyrant* came to signify an abuser of power, particularly of the chief power in the State. The Greek tyrants, who were especially numerous during the seventh and sixth centuries B.C., were frequently humane and beneficent rulers, and patrons of art and literature. Among famous tyrants may be mentioned Pisistratus of Athens, Periander of Corinth, Dionysius, Gelon, and Hiero of Syracuse, and Polycrates of Samos.

Tyre, one of the most celebrated cities of ancient Phœnicia, and with its elder sister, Sidon, long a great trading mart. It was built partly on an island and partly on the mainland; and the insular fortifications formed its chief strength when besieged and taken by Alexander the Great in 332 B.C. A mole or causeway then constructed to the island was the origin of the isthmus which now connects it with the mainland. Tyre was famous in the tenth century B.C. under Hiram, the friend of Solomon, was besieged in vain by the Assyrians from 725 to 720 B.C., and by Nebuchadnezzar from 585 to 572 B.C., and remained an important place till it came into the hands of the Turks. It was famous for a dye (the Tyrian purple) obtained from the shell-fish Murex (q.v.). The modern Tyre or Sur is a place of 5000 inhabitants (3000 Christians). See *Phœnicia.*

Tyre, a circular band surrounding a wheel. It may be made of steel or rubber, either solid or air-filled. A cart wheel is built up from wooden spokes and a wooden rim in sections, all held together and effectively bound to give satisfactory support by a steel tyre, which is put into position when hot and therefore expanded, and is afterwards cooled. The common usage of the word is in reference to the outer part of the wheels of cycles and motor-cars. In the early stages of the evolution of the cycle, solid rubber tyres were used until J. B. Dunlop, a Belfast veterinary surgeon, produced his pneumatic tyre. The suggestion was not altogether novel, for it was originally made by a British engineer, R. W. Thomson, who obtained patents for it in 1845. Dunlop and his associates, however, made a practical proposition of the idea, and it was their successful work which contributed most largely to the enormous developments in cycling and motoring. The earlier type and many of the present-day pneumatic tyres consist of rubber fitted on a lining of rubber and canvas and afterwards vulcanized. They are formed with a section which is almost circular, but with a gap to the inside, and they have thickened and moulded edges by which they are held in the grooves under the turned-over edges of the rim of the wheel. An *inner tube* of rubber is placed in the inside of the tyre and on inflation it provides the necessary resistance to the load pressures. In another type of growing importance the reinforcement for the rubber is made of cord, lapped backwards and forwards from pin to pin on the sides of a shaped wheel. The soft rubber is worked around the cords and is later vulcanized. Similar types to those used on motor-cars, but of much smaller diameter and greater width, are used as landing wheels on aeroplanes. Some of the lighter horse-drawn vehicles, such as trotting machines, are also provided with pneumatic tyres. Security bolts passed through the rims and having a rubber padded upper part for the exertion of pressure between the inner edges of the tyre and the rim assist in holding the tyre in position. Many endeavours have been made to obtain a suitable medium other than air for filling tyres, but with little success. The provision of a lining of some plastic rubber material for the immediate closing up of punctures has also been a quest of the inventors.

Tyrol′. See *Tirol.*

Tyrone, a county of Ulster, bounded on the east by Lough Neagh; area, 1281 sq. miles. The surface is hilly, rising into mountains in the north and south, and declining to a level towards Lough Neagh; and the county is watered by numerous branches of the Foyle and Blackwater. Coal is raised to a small extent near Dungannon in the eastern portion of the county; linens, woollens, earthenware, whisky, beer, chemicals, &c., are made; and there is some agriculture. Strabane, Dungannon, Cookstown, and Omagh are the principal towns. Pop. 142,665.

Tyrrhenian Sea, the name given to that part of the Mediterranean Sea which is enclosed between the Islands of Corsica and Sardinia on the west, the Italian Peninsula on the east, and Sicily on the south.

Tyrtæus, Greek elegiac poet, famous chiefly for his war-songs. It is usually believed that he lived in the seventh century B.C., though Verrall places him in the fifth century, while some scholars deny his existence outright. It is uncertain whether he was an Athenian or a Spartan; the tradition which connects him with the Attic deme of Aphidnæ may have been inspired by the desire of the Athenians to monopolize all literary merit. According to the current legend, he assisted the Spartans in the second Messenian War by means of writing martial elegies and marching-songs. According to a later legend, he was a lame schoolmaster, sent from Athens in fulfilment of an oracle, and chosen on account of his ignorance of soldiering. The extant poems of Tyrtæus are noble and spirited. One of the best known has been translated by Thomas Campbell. Müller says: "When the Spartans were on a campaign it was their custom, after the evening meal, when the pæan had been sung in honour of the gods, to recite these elegies of Tyrtæus. They were, however, never sung on the march of the army and in the battle itself; for these a strain of another kind was composed by the same poet, viz. in the anapæstic marches."

Tyrwhitt, Thomas, English Chaucerian and classical scholar, was born in 1730, and died in 1786. He was educated at Eton and Queen's College, Oxford, becoming a Fellow of Merton in 1755. He was called to the Bar at the Middle Temple, became Deputy-Secretary at War (1756–62), and Clerk of the House of Commons (1762–8). From 1768 onwards he lived a life of learned retirement. He was an accomplished classical scholar, edited two fragments of Plutarch, wrote a dissertation on the fables of Babrius, and gathered material for a most valuable edition (posthumously published) of Aristotle's *Poetics*. His fame, however, rests mainly upon his edition of Chaucer, which was published in four volumes in 1775; the fifth volume, containing a glossary, appeared in 1778. Tyrwhitt is the earliest and greatest of Chaucerian scholars; as an English scholar he is worthy to be compared to Porson as a Grecian. No single man has done as much for Shakespeare as Tyrwhitt has done for Chaucer. He was singularly well fitted to edit Chaucer, as he had a wide knowledge of classical and mediæval literature, a correct ear, and a sense of poetry, and was 'rich in saving common sense'. He purged the works of Chaucer of much foreign matter, corrected the text, elucidated many difficulties, and pointed out 'the pronunciation of the feminine *-e*'. He thus restored to Chaucer, in part at any rate, his grace of language and metre. He was a man far in advance of his age; his edition of Chaucer is a real masterpiece of scholarship. His knowledge and his diligence are so great that the gratitude of later editors to him is somewhat tempered by feelings which make them cry 'Pereant qui ante nos nostra dixerunt'.

Tytler, Patrick Fraser, fourth son of Alexander Fraser Tytler (Lord Woodhouselee), was born at Edinburgh in 1791, and died in 1849. In 1818 he was admitted a member of the Faculty of Advocates, but abandoned the Bar for literature, and wrote his great work *The History of Scotland* (1828–43). Among his other works are his biographies of the Admirable Crichton, Wycliffe, and Sir Walter Raleigh.

U

U, the twenty-first letter and the fifth vowel in the English alphabet. Its true primary sound was that which it still retains in most of the languages in Europe, that of *oo* in *cool, tool, good, wood,* &c., answering to the French *ou* in *tour,* the sound being sometimes short, sometimes long.

Ubangi, a river of Africa, a right-bank tributary of the Congo. It is formed by the confluence of the Welle (Uele) and Bomu (Mbomu), both rising in the Congo-Nile watershed, and joins the Congo by a delta of five mouths, after a course of over 700 miles. The Uele is the southern fork of the Ubangi, and the Ubangi-Uele system has a length of approximately 1470 miles. For the whole of its length the Ubangi forms the frontier between the Belgian Congo and French Equatorial Africa, the boundary being continued by the northern fork, the Bomu. Among tributaries the Bomokandi (left-bank affluent of the Uele) is the most important. The Uele was discovered by Schweinfurth in 1870.[1]

Ubangi, a northern riverine district of the Belgian Congo. Libenge and Banzyville are the chief towns.

Ubangi-Shari, an inland colony of French Equatorial Africa (French Congo), bounded on the south by the Ubangi River. The capital is Bangui. Area, 708,219 sq. miles; pop. 604,700. Formerly the region was known as Ubangi-Shari-Chad, but since 17th March, 1920, Chad has been a separate territory; area, 501,676 sq. miles; pop. 1,271,400.

Ubaté, a town of Colombia, South America, in the department of Cundinamarca, on the Sabiá; served by the northern railway from Bogotá. Pop. 8000 to 10,000.

Ubeda, a city of Spain, in the province of Jaen; served by rail (14 miles) to Baeza (Empalme). It is the centre of the oil and viticultural region of the Loma de Ubeda plateau, and has also a royal stud of horses. Pop. 22,860.

Überkingen, a village of Württemberg, on the Fils; served by the Geislingen-Wiesenstieg line of the State Railways, and noted for its chalybeate bath. Pop. 800.

Überlingen, a town of Baden, on the Überlingersee, the north-west arm of the Bodensee (Lake of Constance, q.v.). It is served by steamer from Ludwigshafen to Meersburg and Constance, and is on the railway to Ludwigshafen and Friedrichshafen. There is a chalybeate spring (temperature, 57·2° F.), and a bathing establishment. Pop. 6000.

U-boat (Ger. *Unterseeboot*), a name applied to German submarines during the European War, and derived from the distinguishing class letter U usually found on the hull or conning-tower of such craft. Germany lost over 200 U-boats, but the actual number destroyed is problematical, although Mr. Lloyd George, speaking on 7th Aug., 1918, said that 150 had then been either captured or destroyed, and that more than half of that number had been immobilized during 1917. German protests on the exaggerated nature of this statement were met by the publication of 150 names of U-boat commanders who went down with their ships or were either captured or interned by neutrals. To this grim testimonial the German Admiralty complained that the rank of several officers was not stated correctly! but belligerents and neutrals alike must immediately have seen that the total names available and printed could only represent a percentage of the U-boats destroyed, since the designation of many commanders would not, for obvious reasons, be available.

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[1] Schweinfurth, Georg August, African explorer, born 1836 in Riga, studied at Heidelberg, Munich, and Berlin, and began his explorations by a series of journeys in the country between the Red Sea and the Nile (1863–6). On behalf of the Humboldt Institution of Berlin he undertook a journey in the heart of Africa, travelling up the Nile, investigating the hydrography of the Bahr-el-Ghazal and plunging in the company of ivory traders into the heart of tropical Africa. He explored the country of the Dinkas, Bongo, and Niam-Niam, and discovered the pygmy Akkas (q.v.), returning to Khartum in 1871. His works include *Im Herzen von Afrika* (published in English as *The Heart of Africa*). Schweinfurth was associated with Gerhard Rohlfs in the latter's expedition into the Libyan Desert (1873–4).

Ucayali. See *Amazon*; *Apurimac.*

Udaipur, a native state of Rajputana, India. It is physically a high plateau with a north-easterly versant, but in the south-west it is traversed by one of the roughest sections of the Aravalli Hills. Agriculture is the chief industry, the chief autumn crops being *til*, cotton, maize, and sugar-cane, and spring crops, wheat, barley, gram, and poppy. There is some forestry, and the state is rich in unexploited mineral resources (tin, argentiferous lead, zinc, iron, garnets, &c.). In the east the Rajputana-Malwa Railway runs north and south. Udaipur City is the capital. Area, 12,691 sq. miles; pop. 1,100,000 (Bhils, Mahajans, Brahmans, Rajputs, &c.). The climate is healthy; mean annual temperature, 77° F. (January 61°; May, 89°); rainfall, 25 inches (14 inches in July and August).

Udaipur, a city of Rajputana, India, capital of the state of Udaipur; served by rail (67 miles) to Chitor. It was founded in 1559 by Rana Udai Singh, after whom it is called. There are some unimportant manufactures of embroidery, arms, and fancy cloth. Pop. 46,000 (mainly Hindus, with some Muslims and a few Jains).

Udall, Nicholas, writer of the first regular English comedy, born 1506, died 1556. He was headmaster of Eton from 1534 to 1541, and the play *Ralph Roister Doister* was written for performance by the scholars. Its authorship was not ascertained till 1825. He was in favour at court as a writer of pageants and interludes.

Uddevalla, a port of Sweden, in the län of Göteborg and Bohus, at the head of the Byfjord; an important railway junction on the Göteborg-Strömstad line (via Munkedal) for Bengtsfors (via Bäckefors). There are a college, a school of navigation, and a polytechnic school; ship-building and other industries, and local fisheries. Exports include herrings, fish-guano, paper, and oats. Gustafsberg watering-place is near by. Pop. 13,600.

Udine, a province of Venetia, North Italy, forming part of Friuli (q.v.); area 2536 sq. miles, pop. 721,800. It comprises (1) a northern zone, traversed by the Carnic Alps and part of the western versant of the Julian Alps; and (2) the Friulian division of the Venetian plain, traversed by the Tagliamento, Livenza, Stella, and Natisone (an affluent of the Isonzo). Among productions are silk, corn, maize, wheat, fruit, and potatoes. The red-coated Friulian cattle are noteworthy. Cheese is produced. Udine is the capital.

Udine, the capital of Udine province, Venetia, North Italy; a railway junction 84¼ miles from Venice, on the line Venice-Tarvisio, for Vienna, Trieste via Monfalcone (53 miles), and for the line Cividale-San Giorgio (29 miles). Industries include silk and cotton spinning and weaving, watch-making, wine-growing, and the manufacture of leather and wooden goods. The mean annual temperature is 55·5° F. (January, 37·6°; July, 75°). Pop. 56,100.

Udine is an archiepiscopal see, and has shared in the fortunes of Friuli generally. During the eleventh century it became the seat of the patriarchate of Aquileia, in which the Emperor Henry IV had vested the ducal authority, and in 1420 passed under Venetian dominion. From 1797 to 1805, when it was added to Napoleon's Kingdom of Italy, Udine was under Austrian sway. In 1808 Marshal Duroc (q.v.) was made Duc de Frioul (Friuli) by Napoleon, but the title and arms were assumed by the Emperor of Austria again in 1815, and from that time until 1866, when it became part of the Kingdom of Italy, Udine was an Austrian appanage.

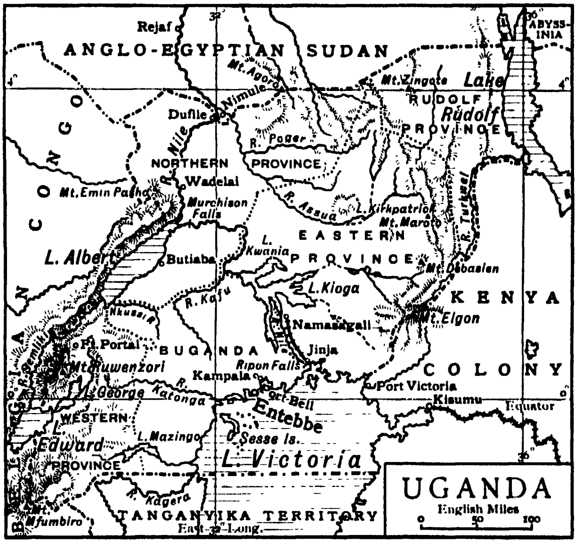
Ufa, a government of Eastern Russia, separated from Orenburg by the main range of the Southern Urals. The western region is a land of alternate hill and steppe, the latter in the black-earth belt. The Ufa River does not rise in the government but in Perm, whence it flows through Ufa to join the Byelaya about a mile above the capital of the government (Ufa); length, 440 miles. The Byelaya is the chief river, and is in turn an affluent of the Kama (q.v.), which forms the western boundary of the government for over 100 miles. Area of government, 47,112 sq. miles; pop. (1920), 2,009,549.

The government of Ufa is drained to the Volga basin, and its rivers form part of the Volga system of navigation. For instance, the Kama is navigable by steamers for 759 miles of its length, the Byelaya as far as the town of Ufa (310 miles) the Vyatka for 475 miles, and the Kolva for 79 miles. The three latter streams are affluents of the Kama, and the Kama basin has about 1945 miles of water-ways navigable by steam-vessels.

Ufa, a town and river-port of Russia, capital of the government of Ufa, on the Byelaya at the confluence of the Ufa; served by the main Siberian line which runs from Samara, via Ufa, over the Urals into Asia. There are considerable manufactures. Pop. 104,480.

Uganda, a British protectorate of Central Africa. It is divided into administrative regions as follows: *Eastern Province*, containing the districts of Busoga, Bukedi, Teso, Lango, Karamojo, and Lobor; *Western Province*, comprising Toro, Ankole, and Kigezi; *Northern Province*, divided into Unyoro, Gulu, Chua, and West Nile; *Rudolf Province*, with Turkwel, Turkana, and Dabossa districts; and *Buganda*, which embraces Mengo, Masaka, Mubendi, and Entebbe districts. Entebbe (altitude, 3868 feet; pop. 10,000), a port on the northern shore of Lake Victoria, is the chief centre of European culture and the administrative capital of the protectorate.

Area and Population.—The total area is about 110,300 sq. miles, 16,377 sq. miles representing water-surface. Pop. estimated at 3,066,400 (about 3,060,000 natives).



Communications.—The Busoga Railway, connecting Ripon Falls (Jinja), on the Victoria Nile, with Namasagali, and the Kampala Railway (7 miles), linking Port Bell with Kampala, are the chief railways. There is a bi-monthly steamer service on Lake Albert, and on Lake Victoria a weekly steamship service connects Entebbe with Kisumu in Kenya Colony, the terminus of the Uganda Railway to the coast (Mombasa). On Lake Kioga, Namasagali and Port Masindi have steamer connections, interrupted sometimes by masses of *sudd*. An extensive road-system is maintained, and telegraphic and postal services are more or less elaborate.

Production.—Uganda is mainly agricultural, and the chief products are native cereals. In some places, however, cattle form the main source of wealth, and cotton may be accounted the principal economic product. Bananas are important and, with millet and pulse, form the native staples. Coffee is an indigenous plant in Buganda, where it is allowed to grow wild; but Europeans cultivate the *Coffea arabica*, which was introduced from Nyasaland, and is now their chief plantation crop. Tapioca, the castor-oil plant, chillies, dhal (the Congo pea, grown especially in Kigezi district as a food-crop), ground-nuts (in Kioga district), maize, rice, rubber (the third crop in economic importance), sesame (Eastern Province), some sugar-cane, large quantities of tobacco, and many other crops are also grown in Uganda. The forestal resources are important, and include species of the African mahogany class, which are valuable for export purposes.

Government.—The protectorate is governed by H.M. the King in Council, authority being relegated to the Secretary of State for the Colonies, to whom the Governor, who has supreme civil and military power, passes copies of his ordinances for approval. There is a complicated system of local government operating on a provincial basis; but this does not apply in the Rudolf Province (q.v.), where a political officer enforces the laws as far as possible. Otherwise, the provinces are controlled by Provincial Commissioners, representing the Governor and exercising judicial authority, while controlling a staff of District Commissioners, who, among other duties, supervise the assessment, &c., of taxes. Buganda (area, 22,734 sq. miles) is a kingdom, of which the *kabaka*, or king (styled 'His Highness'), is a vassal of H.M. the King-Emperor. Local autonomy is more or less completely exercised within his domains. See *Toro*; *Unyoro*; *&c.*

History.—The British protectorate was proclaimed on 19th June, 1894, and the country was immediately garrisoned by the remnant of the army of Emin Pasha, to which was added some irregular Baganda and recruits from the White Nile. This force was successful in dealing with the risings of the Kings of Unyoro and Buganda, but was later superseded by an Indian detachment. In 1897 Mwanga of Buganda and Kabarega of Unyoro again rose, but the rebellion was suppressed, and the two kings were eventually sent into retirement in the Seychelles. Since 1900 considerable political and economic progress has been made.

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Stationery Office), a general handbook; W. G. Kendrew, *The Climates of the Continents* (includes a chapter on the climate of the region); *Kenya, Uganda, and Zanzibar*, No. 96 of vol. xvi, *Peace Handbooks* (H.M. Stationery Office), a general geographical and historical handbook.

Uglich, a town of Russia, in the government of Jaroslav, on the Volga. It has a restored castle, supposed to be the place where the young Tsarevitsh Dmitri, son of Ivan the Terrible, was murdered in 1591 by order of Boris Godunov. Pop. 12,000.

Ugrian, a division of the Turanian group of peoples, the chief subdivision of which is the Magyars or Hungarians, who number upwards of 10,000,000 souls. The other two tribes are the Ostyaks, mainly of Shamanistic beliefs, and the Voguls, who are nominally Christians and are found partly in Northern Europe. The original home of the Ugrians was the eastern or Asiatic versant of the Urals, or the region of the River Ob, whence, within historic time, the Ungars detached themselves from the main group and settled in the basin of the Danube, losing, in course of time, their Turanian characteristics through their free intermingling with Slav and other peoples of non-Turanian blood. There are about 18,000 Ostyaks and 7000 Voguls, both tribes being chiefly hunters and fishermen, and located south of the Samoyeds, in a wide region both east and west of the River Ob.

Ugro-Finns, a branch of the Turanian family of peoples, whose language is known as the Ugro-Finnic (or Finno-Ugric) division of the Ural-Altaic (i.e. Turanian) family (see *Ural-Altaic*). The Ugro-Finns, about 16,000,000 in number, are divided into Finnish and Ugrian sections, the former comprising some 6,000,000, and the Ugrian about 10,025,000. Of the three main divisions of the Ugrians (q.v.) the Magyars are of most importance, and the group is more or less Christian and European. The Finnic group (see *Finns*) has two main sections, Russian and Scandinavian (60,000 distributed over Norway and Sweden). Both the Magyars and the Finns have been greatly influenced by European culture, and have succeeded in preserving the characteristics of their nationality where their less cultured relatives have been more or less slavonized, and will in due course disappear by absorption into the Slav race. Apart from the Magyars and Finns, Christianity has been adopted by most of the Ugro-Finnic groups. Their Christianity, however, is in many cases merely a veneer superimposed upon Shamanism, ancestor worship, and witchcraft.

Uinta Mountains, a range of Utah, United States, east from the Wahsatch range. See *Rocky Mountains*.

Uist (wist), North, an island of the Outer Hebrides, 17 miles long and from 3 to 18 miles broad, separated from Harris by the Sound of Harris. The surface is chiefly flat, the coast greatly broken by inlets from the sea, and the principal industry is fishing. Pop. (1921), 3223.

Uist, South, separated from North Uist by the Island of Benbecula, is 22 miles in length and 7 miles in breadth. The surface is low-lying in the north, but the remainder is mountainous. Lochboisdale is the chief place. Pop. (1921), 4844.

Uitenhage, a town of Cape Province, Union of South Africa, chief town of the district of Uitenhage (2973 sq. miles), a noted centre in the wool-washing region of the Zwartkops River valley. There are large railway repair-shops. Uitenhage is about 20 miles by rail north-west of Port Elizabeth. Pop. 7900.

Ujiji, a district and town of Tanganyika Territory, Africa. The district has a coast-line of over 75 miles on the east shore of Lake Tanganyika, to which it is drained by the Mlagarasi River; and it is traversed from east to west by the Central Railway from Dar-es-Salaam. Yams, sugar-cane, sweet potatoes, ground-nuts, and the oil-palm are the staples. Ujiji town is the chief place, and is associated with such names as Burton and Speke (1858), Sigl (who hoisted the German flag there in 1898), and David Livingstone (who arrived in 1869, and was found at Ujiji by H. M. Stanley on 28th Oct., 1871). The town stands on Lake Tanganyika, about an hour's journey from Kigoma, its port and the terminus of the Central Railway, and it is considered one of the main trading centres of the Territory.

Ukraine (Russ. *Ukraina*, borderland), a Socialist Soviet Republic embracing several of the former governments of South Russia and divided into twelve governments as follows:

Government.	Area in sq. Miles.	Estimated Pop. (1923).**
Donetz *	24,803	2,871,459
Ekaterinoslav	11,520	1,701,535 ^{69}
Kharkov	15,026	2,579,973 ^{81}
Kiev	14,821	3,269,629 ^{80}
Kremenchug *	10,901	1,751,168
Nikolaiev *	14,470	1,820,913
Odessa *	12,116	1,884,626
Podolia	13,247	2,959,115 ^{81}
Poltava	14,979	2,405,426 ^{93}
Saporosch *	12,270	1,543,301
Tchernigov	12,648	1,809,918 ^{66}
Volhynia	12,021	1,404,769 ^{70}
Total	**168,822**	**26,001,832**

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* Governments marked with an asterisk have been created since the Russian Revolution. The others retain their Imperial names but are, of course, very much altered in extent, population, &c. Kharkov is the Ukrainian capital.

** The small figures indicate the percentage of Little Russians (Ukrainians and Ruthenians) as shown by the Russian census of 1897. Odessa City had only 9 per cent of

Physical.—Ukraine comprises (1) a central region of undulating steppe-land belonging to the drainage basin of the Dnieper and extending, with a slight versant from north to south, over the former governments of Tchernigov and Poltava. On the west lies (2) the Black Sea or Avratynsk Plateau, drained by the Bug and Dniester, and extending over Southern Volhynia and all Podolia, with an easterly extension to the Dnieper Valley as the plateau of Kiev. In the east are (3) the table-land of Kharkov and (4) the Donetz Hills, both drained by the Don and the Dnieper. There is a limited but very important seaboard on the Black Sea and Sea of Azov.

The north-western region of Ukraine occupies part of Polyessyē and belongs to the basin of the Pripet. The name (Polyessyē) means ' the woods ', and is used to designate the more or less afforested region, triangular in shape, enclosed by the Berezina and Pripet, tributaries of the Dnieper, and the flat region of Volhynia north of the Avratynsk Plateau. This is an area of swamps and marshes (e.g. Pinsk marshes, 600 sq. miles) from which some 5,000,000 acres of arable and pastoral land have been reclaimed by a canal system initiated by the German colonists. The Polyesian flora is found also in the afforested lowlands of Northern Kiev, and there are riverine zones in Podolia, and in Tchernigov north of the Desna (an affluent of the Dnieper). The industries of Polyessyē and those of the marshy region in Tchernigov are chiefly related to the lumber industry, and include the leaching of wood for potash, boat-building, and the manufacture of wooden dishes; but apiculture, hunting, fishing, and general agriculture are progressive.

Production.—The Black Earth crosses Ukraine from east to west, covering all the former government of Podolia, South and Central Kiev, and part of Ekaterinoslav. This zone is therefore one of the richest agricultural areas in the world, and its astonishing fertility is reflected in the quantity and immense variety of its products. Market-gardening, fruit-farming, viticulture, and the raising of cereals are of great importance, as is also stock-breeding, one of the chief nurseries of the pre-European War cavalry horses of the Russian army being centred in Podolia, where stock-raising is the chief business. Large horse-fairs are held at Kharkov. Apiculture is almost universal, and there is a great sugar industry, of which Kiev is the metropolis. Probably nowhere in the world, except only Scotland, are distilleries so common, and distilling and sugar manufacturing may be said to dwarf by comparison all the other Ukrainian industries put together. If there is any exception to this general statement, the mineral wealth of Ukraine provides it, and the Donetz coal-basin is possibly the greatest single mineral asset in the sadly mangled remains of the Russian Empire. Owing to its agricultural, mineral, and manufacturing wealth, the Euxine, Don, and Dnieper fisheries, and the possession of a large and brisk foreign trade through the ports of Odessa, Ochakov, Mariupol, and Nikolaiev, Ukraine is obviously an exceedingly valuable partner in the Union of Socialist Soviet Republics. See articles on former Imperial governments; *Black Sea*; *Tchernozem.*

Donetz Coal-basin.—The Don Hills or Donetz hill range lies west of the Donetz River, trending in a south-easterly direction from near Zmiev in Kharkov to the confluence of the Donetz with the Don, a distance of roughly 250 miles. It has eastern and western branches, and comprises the western part of the Don Cossack Territory, north-eastern Ekaterinoslav, and part of Kharkov, with an area of about 17,740 sq. miles. (All references are to pre-Revolutionary governments.) The western branch extends to the Dnieper Valley, and attains an altitude of 850 feet; the eastern branch runs to near Lugansk and attains an altitude of 1145 feet at Ivanovka. Partly in these hills and astride the Donetz River lies the Donetz coal-basin, 10,425 sq. miles in area, enclosed by the Volchya (a tributary of the Dnieper) in the west and the Kagalnizk (a tributary of the Don) in the east. The eastern and central parts of the basin provide anthracite, and the west bituminous, coal, both of which have been regularly worked since 1839. Other minerals of the region are: chalk, lime, iron (from the Krivoy-Rog deposits), kaolin (from Poltava), argentiferous lead, rock- and brine-salt (chiefly from Slavyansk), manganese (from Nikopol, near Krivoy-Rog), and cinnabar, the chief ore of mercury. See *Donetz*; *Don*; *Ekaterinoslav.*

Literature.—Long before the Ukraine, or Little Russia, was annexed by the rulers of Moscow, it possessed a literature of its own. Kiev was the intellectual centre, and it was there that the old Russian chronicles were compiled. Famous are the *Chronicle of Nestor*, the *Testament of Ostromir*, and the *Song of Igor*, which may be compared to the *Chanson de Roland.* The origin of the heroic songs of the Ukraine, known as *Doumy* (to be distinguished from *Bylini*, q.v.), is traced back to the ninth and tenth centuries. During the Mongolian invasion Ukrainian culture and literature exercised a considerable influence in Lithuania. Abandoned by the nobles during the seventeenth century, Ukrainian literature was cultivated by the clergy, and especially among the Cossacks. The epic poetry of the period, one of the richest and most beautiful of popular Slavonic poetry, deals with the exploits of the Cossacks and of their famous hetmans, Samuilo Kyshka, Semen Palyi, and others. Under Catherine II the Ukraine became russified, and the literary works of the country were written mostly in Russian or in Polish. The national spirit of the Ukraine was, however, still alive. The philosopher Gregory Skovoroda (1772–94), Gogol, and Korolenko were Ukrainians, but they wrote in Russian, just as the Swiss Rousseau and the Belgian Maeterlinck wrote in French. The renaissance of the real Ukrainian literature was inaugurated towards the end of the eighteenth century by Ivan Kotlyarevsky (1769–1838). He did for the Ukrainian language what Lomonossov and Pushkin had done for the Russian, and raised the popular Ukrainian idiom to a literary language. Among other works Kotlyarevsky wrote two comedies, *Natalka Poltavka* and *The Soldier-*

Little Russians, the major portion of the population being Great Russians and Jews. Kherson, a former government, now more or less represented by those of Odessa and Nikolaiev, was 54 per cent, and Taurida 42 per cent, Little Russian. Of a total population of 26,001,832 (as above) about 76 per cent is Little Russian, and the Republic is therefore, according to modern ideas, a satisfactory ethnic unit.

Sorcerer. Kotlyarevsky's example was soon followed by numerous other writers. The great poetical genius of the Ukraine was Taras Ghevtshenko (1818–61). His collection of poems, *Kobzar*, appeared in 1840, and *The Haidamaks* in 1841. He was an apostle of liberty, the Ukrainian prophet and poet. More recent writers are: Marie Markovitsh (Marko Vovtshok), whose tales have been translated into Russian by Tourgueniev; Ivan Franko; Lesia Oukraĭnka (Larissa Koitka); Khrystia Altshevska; the historian Myrkhailo Hroutshevsky; and Vladimir Vinnitshenko.

Ulcer is a suppurating area on a free or open surface; an open sore. There are various forms of ulcer: *follicular*, a small ulcer on a mucous membrane; *gastric or peptic ulcer*; *rodent ulcer*, which involves all tissues and is malignant in type (see *Cancer*); *serpiginous*, an ulcer which, while healing at one part, is progressing at another part; *perforating ulcer*, one that eats through the wall of the affected organ; *tuberculous ulcer*, due to tuberculosis; and *varicose ulcer*, due to varicose veins (q.v.).

Uleåborg (üleobor'; Fin. *Oulu*), the largest and most northerly department of Finland. It comprises in the east and north the plateaux of Laponia (16,000 sq. miles; 1100 feet altitude), which are largely barren, and are inhabited by some 600 nomadic Lapps, who own upwards of 100,000 reindeer; and in the west, the northern zone of the Österbatten, or rich plains of the Gulf of Bothnia. North of Uleåborg town the coast is fringed with sand-dunes. None of the rivers (Tornio, Uleå, &c.) are navigable, and are therefore used for floating timber. Lakes include Uleå, Enare (in the far north), Kianta, and Piha. Uleåborg (officially *Uleåborg and Petsamo*) is served by the Tornio-Petrograd trunk line (see *Tornio*), which sends a branch along the Kemi River from Kemi to Rovaniemi, an important timber centre. The chief towns are Uleåborg (capital), Tornio, Brahestad (Fin. *Raahe*; a seaport on a branch of the main trunk railway; exports pitch, tar, timber, &c.; pop. 5000), and Kajana (Fin. *Kajaani*), the terminus of a branch line from Kuovola, running via St. Michel (Fin. *Mikkeli*) and Kuopio. There are great forests, and extensive fisheries in the Gulf of Bothnia and the lakes. Area of department, 65,127 sq. miles; pop. (1923), 370,800.

Uleåborg, a seaport-town of Finland, on the Uleå River and the Gulf of Bothnia; served by rail from Tornio. It is an industrial place whose prosperity is founded on leather, and it is the tanning and boot- and shoe-making metropolis of Finland, possessing also the oldest and largest sole-leather factory (that of Bröder Aström Aktiebolag) in Northern Europe. Imports include coal, iron, and foreign produce; and among exports are butter (some of which goes to Denmark, where it is re-exported as Danish butter), tar, pitch, fish, and lumber (including sawn wood, the Uleå River being largely used for timber-floating). Uleåborg was founded in 1605, and, during the Crimean War, Plumridge, with a British fleet, burned the dockyard, &c. (1st June, 1854). Pop. 21,400.

Ul'filas, Ulphilas, or **Wulfilas,** Bishop of the Goths of Mœsia, born in A.D. 311, died at Constantinople in 381. He translated most of the Bible into Gothic (Mœso-Gothic), employing the Greek of the *Septuagint* for the Old Testament, and a Greek text, different from the received text, for the New. Only some fragments of this translation have been preserved, including the greater part of the four gospels, and these are of the highest linguistic value. See *Goths.*—Cf. C. A. A. Scott, *Ulfilas: Apostle of the Goths.*

Ullswater, a lake in England, between the counties of Cumberland and Westmorland, about 7½ miles long, and varying in breadth from ¼ mile to ¾ of a mile; depth, 210 feet.

Ulm (ụlm), a town of Württemberg, on the Danube. Its manufactures include machinery, woollen and linen cloth, leather, paper, and brassware. A free Imperial city in the fourteenth and fifteenth centuries, Ulm was annexed to Bavaria in 1803, but became part of Württemberg in 1810. The capitulation of Ulm in 1805 was the turning-point of the campaign of Austerlitz. From 1842 to 1866 it was a fortress of the Germanic Confederation. Ulm is an important junction on the Stuttgart-Munich Railway, via Geislingen, for Aalen, Memmingen, Sigmaringen, and Friedrichshafen. Pop. 59,000. —*Neu-Ulm*, a modern town of Bavaria, stands on the Danube, opposite Ulm. Pop. 11,000.

Ulma'ceæ, a natural order of dicotyledons, of which the genus Ulmus or elm is the type. It is nearly related to Urticaceæ (the nettles), from which it differs only in having a two-celled fruit and hermaphrodite flowers. It consists of trees or shrubs, which have scabrous, alternate, simple, deciduous leaves and fugacious stipules.

Ulpian (Ulpianus), Roman jurist, a citizen of Tyre, born about A.D. 170, assassinated 228. Justinian, in his *Digest*, made large use of Ulpian's legal works, quoting over 2700 extracts.

Ulster. *History.*—The modern name Ulster, like Leinster and Munster, is a hybrid, and comes from the Icelandic *Staor*—a steading, added to the name *Ulaidh.* It is really the name of the ancient population, or tribe, which inhabited the land. In earliest times Ireland was divided into five principal provinces or kingdoms—Ulster, Munster, Leinster, Connaught, and Meath—which were each in turn divided into lesser divisions or chiefdoms. It would appear, however, that Ulster was always the strongest and most independent, also the most turbulent, of the greater provinces, and its dominant princes or chieftains, the O'Neils and the O'Donnels, disputed with one another and with the other Irish princes for the over-lordship of the whole island.

It was the misfortune of Ireland, which was never a nation in the true sense of the word, that her chieftains were never united for the well-being and protection of the country. For almost two hundred years previous to the first landing of the English in Ireland the country was desolated, devastated, and depopulated by constantly recurring petty internecine wars, in which chieftain strove with chieftain for the supremacy. Each king or prince desired to become the *Ard-Ri* (chief sovereign), and no sooner had one achieved this position than he was thrown from power and another seized the mastery. To such a state of degradation and misery, morally and materially, did the Irish sink that their condition became a scandal to Christendom, and Pope Adrian IV was compelled to intervene and order Henry II to "enter Ireland, and reform its faith, morals, and government".

With the coming of the English, Ulster was granted as a palatinate to a Norman knight named de Courcy, the Ulster chieftains still holding their rights and many of their former privileges. Henry VIII and Queen Elizabeth were, however, the first English sovereigns whose rule was really respected, if not obeyed, in Ulster. Proud and fiercely independent, the Ulster chieftains, O'Neil and O'Donnel, strove desperately to rid the country of the English. Forced to submit, they eventually rendered homage to Queen Elizabeth and accepted the titles of 'Earl of Tyrone' and 'Earl of Tyrconnell' in lieu of their royal titles 'The O'Neil' and 'The O'Donnel'. But their submission was short-lived, and they were again found guilty of plotting against England with France and Spain. Fearing the consequence of their treachery, they fled to Europe with their families and a few of their retainers, and their chieftainships were never restored. Their flight, commonly known as 'The Flight of the Earls', marked a new era in Irish history, for it was then that the 'Great Plantation' of Ulster was made by the ancestors of the race now known as the 'Ulster Scots'.

The accession of James I and VI to the English throne brought about the union of the English and Scottish crowns (1603). The condition of Ireland gave the new sovereign and his advisers cause for grave anxiety, and a scheme, which King James claimed to have personally organized, was set on foot to colonize the lands forfeited and deserted by the Ulster chieftains with families of Lowland Scottish and North English birth—"being Protestants". These Ulster estates covered six counties—Tyrone, Coleraine (afterwards entitled Londonderry), Donegal, Fermanagh, Cavan, and Armagh—and measured about a million acres, of which one-third was bog-land, mountainous, and wooded territory. The colonists were carefully selected, and were, for the most part, taken from the ranks of the nobility and gentry and retired soldiers, who had proved their loyalty to Queen Elizabeth and her successor. The colonists were given the names of 'Servitors', 'Undertakers', or 'Planters', and they obtained free lands, by royal grant, from the English king and his Government under certain conditions. They were to render numerous services to the Crown in return for their lands, and, from within two years from the date on which they entered into possession, they were to have commenced to erect "defensive buildings for the protection of the colony" as a whole. The greater colonists were permitted and, indeed, were obliged to bring with them "suitable families wherewith to people their estates and assist in the work of colonization and the promotion of industry".

Ulster had been left desolate and ruined after centuries of strife. The land was untilled and unfruitful; the natives were dying of famine and disease. If this misery was to be rectified, the marsh-lands had perforce to be drained, the forests cut down, and life made secure. One of the stipulations which King James made to the 'Planters' was that they "should speedily build towns and villages, erect churches and schools, and establish thrifty industrious habits amongst the natives". Nor was that all that was expected of the 'Undertakers'. For a century or more Ireland had been a constant danger to the English Government. Imbued with jealousy, more than actual hatred, towards their English rulers, the Irish chieftains had constantly intrigued with the Catholic Powers, Spain and France, to bring about the downfall of Protestant England. It was urgent, therefore, that a standing army should be maintained in Ireland which could be relied upon to render immediate service to the Crown when occasion required. It was consequently arranged that the 'Undertakers' should supply the force needed "with men, arms, and ammunition". Every colonist was under obligation either to furnish a troop or to serve in one, according to the size of his land grant. The wealthier colonists were expected to give from their estates so many men-at-arms and to lead them in person; while the lesser 'Planters' and tenants supplied a few soldiers or rendered personal military service. It is estimated that in the first year or two after the 'Plantation' was founded the six counties thus colonized mustered over 7336 well-armed men, which in a settled country would imply a population of about 29,000; but it would be safer to reckon upon not more than 20,000 colonists as existing during the first generation after the arrival of the earliest ' Planters '.

The colonists of Ulster founded the first of the colonies or Oversea Dominion States, which, taken collectively, are now known as the ' British Empire '. Until the formation of the Ulster colony, England had made no permanent overseas settlement, simply because, as in the case of all previous attempts to colonize Ireland, the colonists had not taken their womenfolk into exile, and the early English settlers in Ireland, as elsewhere, had intermarried with the natives and become ' more Irish than the Irish '. The Ulster ' Planters ', however, took their wives and children into "this veritable wilderness", as a contemporary writer described it.

In return for the tilling of land, and all the military and civil services which the holding of these lands entailed, King James and his Government assured the colonists on oath that " They and their descendants would for ever retain their rights and privileges as freeborn English citizens ", and " in case of attack by the King's and their enemies, they could rely upon His Majesty's assistance and sympathy ".

The colonists were naturally a strong, stern folk. Two-thirds of them were adherents of the Calvinistic faith, and belonged to the Scottish Presbyterian Church, and it may be said that the Ulster colonists have lived from that time (1607) to the present day a people standing apart and alone. Within a few years of their coming the six north-eastern Irish counties were transformed. Every tillable piece of ground began to yield increase, new towns had sprung up, schools were founded, and law and order were established. The Civil War in England, however, extended to Ireland, where the Irish took up arms in favour of the Stewart king, and seized the opportunity to rush upon the Protestant Ulster colonists, whom they overpowered and all but exterminated. This terrible massacre of the ' Planters ' was cruelly avenged by Cromwell (1649–52), who banished the Catholic Irish from Ulster. Under Charles II many of the laws which bore heavily upon the Irish Catholics were relaxed, while the Ulster colonists, as Nonconformists, were subjected to persecution at the hands of the king's Deputies and Ministers. The injustice of the treatment shared by the Ulster colonists with their Scottish kindred across the channel was increased by the fact that they had favoured the restoration of Charles II. Ireland was comparatively quiet when James II succeeded to the throne (1685). Once more, with the outbreak of civil war in England, Ireland burst into flames. In April, 1689, Londonderry, the capital at that time of the Ulster colony, was attacked by the French and Irish armies under the personal command of James II. After a siege of 105 days the city was relieved by some English ships, which broke through the boom laid by the army of James across the River Foyle and supplied the garrison with food and ammunition. James II met with final defeat on the banks of the River Boyne, where, on the 1st of July, 1690, King William and his Dutch and English army, supported by the Ulster colonists and a number of French Huguenots, gained the victory over the last of the Stewart sovereigns.

The history of all Ireland, including Plantation Ulster, presented, from the year 1698 to the year 1798, a doleful picture of mismanagement and incompetence. The Ulster colonists suffered continual persecution and injustice as Nonconformists, as the Irish also suffered for adhering to the Catholic Church. The industries of both Plantation Ulster and Catholic Ireland were destroyed by order of the English Government, which detested alike Catholics and Nonconformists. Goaded and infuriated, many of the colonists sailed for America, where, on the outbreak of the War of Independence, many of them joined Washington's army. Two-thirds of the names appended to America's Declaration of Independence are those of Ulster Scots.

In 1798 a rebellion broke out all over Ireland, in which, for the first and only time in history, the persecuted Irish Catholics and the Ulster Presbyterian colonists united to secure the religious freedom denied to both sects by the British Government. The rebellion proved unsuccessful in the opinion of the Irish Catholics, who desired utterly to destroy English rule in the whole island. The Ulster colonists, however, when they were permitted to worship God after their own fashion, once again became the most loyal of British subjects. The Act of Union was passed in 1801, under the parliamentary leadership of William Pitt, and largely owing to the genius of an Ulster Scot—Lord Castlereagh—the ancestor of the present Marquess of Londonderry, and from that date until 1921 Ireland ceased to have a Parliament of its own. The unfair land laws which held good in the greater part of Ireland did not trouble Plantation Ulster, where tenants had always possessed interest in their land holdings and could sell or leave at will. Consequently Ulster did not experience the same dire need for the Land Law Reforms which were introduced by Gladstone in 1870 and 1881. In 1886 Gladstone brought forward a Home Rule Bill for Ireland, which was heavily defeated in the House of Commons (see *Home Rule*).

Ulster was bitterly opposed to any measure that would give Ireland, as a whole, self-government. This opposition was based on the fact that the Ulster Scots were different by race and religion to the Irish, and as the Irish resented being ruled by a British Parliament, so they—the 'Planters'—objected to be governed by an Irish Parliament, the majority in which would be, both by blood and religion, as 'foreign' to them as the English were 'foreign' to the Irish.

Another Home Rule Bill was defeated in the House of Lords in 1893. In 1912 Mr. Asquith introduced yet another Home Rule Bill, which, owing to the operation of the Parliament Act, the House of Lords was powerless to stop. Ulster refused to enter an Irish Parliament, and the Ulstermen prepared to resist the attempt to force them against their wish out of the Imperial Parliament. They pointed to the Oath taken by James I, whereby their rights and liberties as English citizens were to be for ever respected. In 1911 Sir Edward Carson—afterwards Lord Carson—was unanimously elected leader of Ulster, and in Sept., 1912, under his guidance, the men and women of Ulster bound themselves together under 'the Oath of the Covenant' to use all means which might be found necessary to defeat the conspiracy to set up a Home Rule Parliament in Ireland. Within a year the province was in possession of a Volunteer force of 100,000 men. This force was lacking in arms and ammunition when, in March, 1914, Mr. Asquith's Government issued an order to some British cruisers to proceed to Belfast—the modern capital of Ulster—and to some troops (infantry, cavalry, and horse-artillery) to make certain movements in Ulster. The only effect of these orders was that certain army officers garrisoned in Ireland resigned. Thoroughly alarmed, however, the Ulstermen realized their need for modern weapons; and, in April, 1914, they contrived to purchase, bring into harbour, unload, and, in a few hours, distribute over the six 'Plantation' counties, a large number of rifles, with ammunition. On the 4th of Aug., 1914, the European War broke out. In the House of Commons, John Redmond, the Irish leader, offered the services of his followers to the Empire for the "defence of the shores of Ireland". Sir Edward Carson, speaking on behalf of Ulster, offered the Ulster Volunteers for "Imperial foreign service in the field", only stipulating that they should be recognized as "a separate and distinct division" and that "no attempt would be made during their absence to bring the Home Rule Bill into law". The Government agreed to these simple terms, and Sir Edward Carson, in person, led his followers to the recruiting station, where 'the Covenanters' formed themselves into the historic 36th (Ulster) Division.

From that time on Ulster steadfastly upheld the Empire's cause in the war. In the great shipyards of Belfast work was carried out, day and night, without a strike, for four and a half years, and the Ulster linen factories and mills, also working day and night and without strikes, achieved the gigantic task of supplying the linen needed for the Air Forces of the Allied armies of Britain, France, Italy, Belgium, Serbia, and America. The enemy had seized all the flax-growing and flax-spinning districts of the Continent. Ulster alone could supply the material, the factories, and the trained industry for the manufacture of 'the wings' for the Allied aeroplanes. Meanwhile Mr. Asquith and his party disregarded their promise to Ulster, and no sooner had the Ulster 'Covenanters' been enrolled in the Imperial army than he and the Liberal Government placed the Home Rule Act on the Statute Book, excusing this breach of faith by the promise that it should not be brought into force until a certain period after the declaration of peace.[1]

In the General Election of 1918, after the cessation of war, practically all Ireland, outside the frontiers of the six north-eastern 'Plantation' counties, returned Sinn Fein, anti-British candidates, whilst the six Ulster counties voted, almost to a man, for the support of the Empire and the Coalition Government. The newly elected Sinn Fein representatives refused to take their seats in the Imperial Parliament, and the Sinn Fein Volunteer army, assisted by the rebellious population of the south, east, and west of Ireland, opened a species of guerilla warfare against the Crown forces, and against Plantation Ulster and all loyal persons of English and Irish birth who were resident in the disaffected parts of the island. The rebels were careful never to meet the Imperial forces in fair and open fight, but contented themselves with carrying on the most cruel and cowardly campaign against unarmed and insufficiently armed people, whom they murdered in cold blood, and in open daylight, regardless of sex or age. The houses, factories, farms, and shops of the loyalists dwelling outside the frontier of the Ulster counties were burned, robbed, wrecked, and confiscated. A reign of terror and misery ensued, and the King's Writ ceased to operate in all parts of Ireland beyond the boundaries of the 'Plantation'. The Imperial forces, soldiers, and police were outnumbered and killed; their hands were tied by the weakness of the Government, which was averse to the adoption of strong measures for the suppression of the rebels. In 1919 the Sinn Fein leader, Mr. de Valera, proclaimed 'an Irish Republic', independent of

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[1] For a brief account of the rise of Sinn Fein and of the 1916 rebellion, see *Ireland.*

Great Britain, and summoned a rebel Parliament in Dublin, called the *Dail Eireann*. Financed by large money loans, and reinforced by men and arms from America, the insurgents continued their campaign of assassination and destruction. Ulster steadfastly supported the Empire, and as steadfastly adhered to the determination never to accept an Irish Parliament for the six north-eastern 'Plantation' counties, where the Crown and Empire were obeyed and loved. Meanwhile 'The Ulster Council', an elected political body, which had been formed in 1910–1 to guard Ulster's interests, still wielded control in the Imperial province. Eventually Mr. Lloyd George, the Premier, and the Coalition Government at Westminster were obliged to acknowledge that Ulster could not be coerced or persuaded into submission to an Irish Parliament. The Home Rule Bill was still in 1920 awaiting the date on which it was to come into force, and it was altered in so far that the six north-eastern Ulster counties of Plantation Ulster were excluded from the Irish State and given a separate Parliament—to be known as 'The Parliament of Northern Ireland'.

Ulster, though strongly averse even to partial separation from the Imperial Parliament, accepted the Act, which safeguarded and guaranteed the rights of Ulstermen within the Empire, gave them representation in the Imperial Parliament, and removed, once and for all, the danger of domination by an Irish Government. Elections were held in the six Ulster counties, and Sir James Craig became the first Ulster Premier, with the Hon. Hugh O'Neill as Speaker. On the 22nd of June, 1921, King George V made his State entry into Belfast and opened the first Ulster Parliament in person. Plantation Ulster was henceforth responsible for its own affairs.

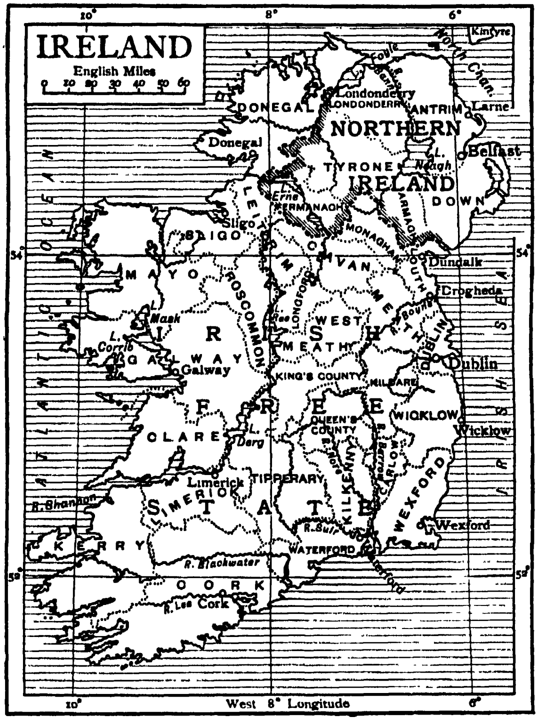
Sir James Craig and his Government had undertaken an almost impossible task. The Sinn Fein rebel forces immediately concentrated upon the Ulster borders, and imported 'gunmen' —many of these being hired Mexican and American adventurers—into Belfast, Londonderry, and other Ulster towns. These 'gunmen' shot down peaceful citizens in the trains, trams, and streets, in open daylight, in crowded streets, in factories, and even in churches. Men, women, and children were alike victimized. They also set fire to the shops, factories, and shipyards in the industrial centres, whilst in the country districts organized attacks were made on farms and property all over the province: horses and cattle were mutilated, crops ruined, and banks were robbed, chiefly along the frontiers of the six counties. The Ulster Government, not having had time to get its police force into order, was, for a time, unable to cope with these raids, but eventually almost the entire male inhabitants of Ulster enlisted in a civil police force for the defence of their homes, property, and province, and in a comparatively short period the rebels retired across the Ulster borders.

Such was the situation in 1923. Ulster, though possessed of its own Parliament, clings as closely as ever to Great Britain and the Empire, and jealously preserves the British rights and liberties of its people, its territory, and immense industries by the strength of its magnificent military police force, which stands guard on the Ulster boundaries. — Bibliography: Ramsay Colles, *The History of Ulster* (4 vols.: Gresham Publishing Company); S. J. Brown, *A Guide to Books on Ireland.*

Northern Ireland.—A self-governing state of Northern Ireland came into being in accordance with the Government of Ireland Act, 1920. It occupies part of the former province of Ulster, and is composed as follows:

Divisions.	Population.
Counties:	
Antrim	193,870
Armagh	120,290
Down	204,300
Fermanagh	61,840
Londonderry	99,850
Tyrone	142,670
County boroughs:	
Belfast	386,950
Londonderry	40.780
Total	**1,250,750**

The total area is about 3,351,870 acres. Protestants are in the majority in Northern Ireland, there being approximately 430,160 Roman Catholics against 768,060 Episcopalians, Presbyterians, and Methodists, and 52,530 others. There is a Ministry of Education controlling all departments of education, and there is a University (Queen's) of Belfast, and about forty technical (polytechnic) schools. Police functions are exercised by the Royal Ulster Constabulary, having an establishment of approximately 3000 men. A Supreme Court of Judicature exists, from the ruling of which there is no appeal except to the House of Lords. *Production.*—Northern Ireland is very highly industrialized, the manufacturing industries, mainly linen and shipbuilding, being most highly developed in the Belfast area. Some 24,000 men are employed in the shipbuilding yards of Harland & Wolff alone, and the yards are capable of an output of 250,000 tons per annum. The linen industry has flourished since the time of James I, and now employs upwards of 84,000 persons in the manufacturing process, the annual output approximating £11,500,000 in value per annum. Other industries include rope-making, and the manufacture of tobacco, alcohol, soap, cement, iron and steel, aerated waters, and biscuits. The mineral output includes chalk, clay, iron ore, limestone, rock-salt, sandstone, and some coal and gypsum. Agricultural development is limited by the nature of the country. Potatoes form the chief crop, turnips, hay, oats, and flax being next in output-tonnage. There is a growing live-stock industry and some dairying.



Government.—There is a Governor appointed by the king, the Duke of Abercorn being the first to take up the appointment. The Parliament is bicameral, consisting of a Senate (24 elected and 2 official members) and a House of Commons (52 elected members). Thirteen members are sent to the Imperial Parliament. The Cabinet comprises a Prime Minister and other ministers holding portfolios of Finance, Home Affairs, Labour, Education, and Commerce and Agriculture.

Ultramicroscope, an apparatus for causing extremely minute particles of matter to become visible. From one side a very bright light is concentrated on the material; the particles scatter the light and become luminous, and when a powerful microscope is focused on them, they are seen by means of the diffraction effects which they cause; their outline is not perceptible.

Ultramon'tanism, the views of that party in the Church of Rome which places an absolute authority in matters of faith and discipline in the hands of the Pope, in opposition to the views of the party who would place the national Churches, such as the Gallican, in partial independence of the Roman curia, and make the Pope subordinate to the statutes of an œcumenical council. The Vatican Council of 1870 virtually established the views of ultramontanism as dogmas of the Church.

Ultra-violet Rays, rays of the nature of light which are invisible to the eye; in a spectrum, they are situated beyond the violet, and have shorter wave-length than the visible rays. At the extreme violet end of the visible spectrum, the rays have a wave-length of about 4000 Ångström units; the ultra-violet spectrum has been traced to beyond 1000 Ångström units. The rays are contained in sunlight, but the shorter waves are absorbed by the atmosphere. The electric spark or arc is very rich in ultra-violet, especially when passed between electrodes of zinc or aluminium. When these rays fall on a mixture of hydrogen and chlorine gases, they cause the mixture to combine with explosive rapidity; when received on a photographic plate, they affect the plate in the same way as light but in a greater degree; hence the rays are sometimes called chemical or actinic rays. The rays undergo reflection, refraction, interference, absorption, and polarization, and are subject to the ordinary laws of light. When the ultra-violet spectrum of a given source is to be examined, it is necessary to use a prism and lenses of quartz or fluorite, since glass (with the exception of 'uviol' glass) is highly absorbent to the ultra-violet. Schumann (1841–1913) studied these rays by means of a vacuum spectroscope with fluorite prism and lenses; he also perfected a photographic plate which was much more sensitive to ultra-violet than the ordinary plate in which the gelatine acts as a strong absorber. Ultra-violet radiation excites fluorescence in bodies which possess this property. Stokes employed a fluorescent screen to explore the ultra-violet spectrum. Rays of ultra-violet when incident on a metal plate charged with negative electricity cause the plate to lose its charge. The effect is one of ionization; the vibrations liberate electrons from the surface of the metal, and these pass into the surrounding space with their negative charges. If the rays fall on an insulated uncharged metal plate, the latter acquires a positive charge. This electrical action has been employed in the 'photo-electric cell' for the purpose of measuring the intensity of the radiation at different parts of the ultra-violet spectrum; the intensity can also be measured by absorbing the radiation and measuring its heating effect by means of a bolometer or thermopile.—BIBLIOGRAPHY: J. A. Crowther, *Ions, Electrons, and Ionizing Radiations*; H. S. Allen, *Photo-electricity*; T. Lyman, *Spectroscopy of the Extreme Ultra-violet*.

Ultra Vires (Lat., beyond powers). When a corporate body does an act outwith the scope of the powers contained in its charter or necessarily incidental thereto, such an act is said to be *ultra vires* and is void. If, for example, a company incorporated under the Companies Acts has power by its Memorandum of Association to run only electric tramways, and its directors commence also to run motor-omnibuses, such a proceeding is *ultra vires* the company and invalid. Directors who do an act which is *ultra vires* may render themselves personally liable.

Ul'verston, an urban district, seaport, and town of England, in Lancashire, about 1½ miles from Morecambe Bay, to which there is a canal. It manufactures iron, steel, chemicals, hardware, boots and shoes, &c., and there is a small shipping trade. Pop. 10,120.

Ulysses (ū-lis'sēz; in Gr. *Odysseus*), king of the Island of Ithaca, was one of the Greek heroes who engaged in the war against Troy. In returning to his own country after the siege he visited the country of the Lotophagi in North Africa, the Cyclopes in Sicily (see *Polyphemus*), the island of Æolus king of the winds; reached the island Ææa, where Circe changed (temporarily) his companions into swine; visited the infernal regions, where he consulted the soothsayer Tiresias how to return to his country; passed in safety the coast of the Sirens, and the dangers of Scylla and Charybdis; remained for seven years with the nymph Calypso after losing all his men; and at last, after an absence of twenty years, returned to Ithaca. Here he found his palace occupied and his substance wasted by suitors for the hand of his wife Penelope, but with the aid of his son Telemachus he put them to death. He lived about sixteen years after his return. These adventures of Ulysses are the subject of Homer's *Odyssey*.

Uman, a town of Ukraine, in the province of Kiev; the terminus of a branch railway. It is a corn-exporting centre. Pop. 30,000.

Umbellif'eræ, an extensive and important natural order of plants, the flowers of which are almost always in regular compound umbels (see *Inflorescence*). The plants of this order are natives chiefly of the northern parts of the northern hemisphere, and nearly all herbs with fistular furrowed stems and divided leaves; the fruit consists of two indehiscent ridged carpels united by a commissure. Some are very poisonous, as hemlock and certain others; others are esculents, as celery, carrots, and parsnips; many yield aromatics, as caraway, coriander, dill, anise; a few secrete a fœtid gum-resin, much used in medicine, as asafetida, galbanum, opopanax, and sagapenum.

Umber, a well-known mineral pigment, of an olive-brown colour in its raw state, but much redder when burnt. It occurs naturally in veins and beds, or is prepared artificially.

Umbrellas (from Lat. *umbra*, shade) were in use among the ancient Egyptians, in the Far East (chiefly by royalty), and to some extent in Greece and Rome. By the reign of Queen Anne they had reached England in a heavy and cumbrous form, the fabric of the covering being frequently of leather. A specimen was often kept in coffee-houses for the use of guests. Umbrellas, originally imported from abroad, are now an important item of home manufacture.

Umbrella-bird, a South American perching bird (*Cephaloptĕrus ornātus*), family Cotingidæ, remarkable for the crest of blue-black feathers rising from the head and curving towards the end of the beak.

Umbria, a province of Italy, deriving its name from the Umbri, by whom it was inhabited in ancient times. It now forms the department of Perugia. The Umbri were an important Aryan people akin to the Oscans and the Latins.

Umlaut (Ger., sound-change, from *um* and *laut*), a term applied in comparative philology to the change of a vowel through the influence of a following vowel (*a*, *i*, or *u*). This sound-change occurs in the Indo-Germanic languages, but is characteristic especially of the Teutonic family. In German *a*, *o*, and *u* are changed into *ä*, *ö*, and *ü*, as in *hand*, *hände*; *sohn*, *söhne*; *bruder*, *brüder*. Traces of umlaut in English are found in *men* and *mice*.

Umta'li, a town of Southern Rhodesia, the head-quarters of the Beira-Mashonaland Railway, which has repair-shops there. Lead, silver, copper, and iron are worked near the town, which is the centre of Umtali district and the British Manicaland gold-fields. The climate tends towards malaria, and the mean annual rainfall is about 30·6 inches (wet season, November to March); altitude, 3571 feet. Pop. (white), 1500.

Uncinula, a genus of ascomycetous Fungi, family Erysiphales. *U. spiralis* is the true or powdery vine mildew, formerly known as *Oidium Tuckeri*. This pest readily succumbs to spraying with flowers of sulphur or a solution of potassium sulphide ($\frac{1}{2}$ oz. to the gallon). Another species, *U. Aceris*, is not uncommon on leaves of sycamore.

Unconformable. See diagram and definition under *Geology* (section *Stratigraphical Geology*).

Unconscious, The, a psychological term used in several ways. It denotes a bodily state during which consciousness disappears. It is also applied to the philosophy of Hartmann, who called the absolute principle the *unconscious*. In the Freudian doctrine of psycho-analysis the term unconscious is applied to the factor of experience which is not discoverable as a state of consciousness. Freud, who asserts the continuity of all mental life, maintains that the unconscious is made up of primitive inherited impulses and desires; and that the unconscious mind consists of all that domain of the ego which is unknown, and is made manifest in dreams, trances, &c. It is a store-house wherein is preserved all that has entered the mind through sensation, and which, though forgotten, is still operating in our minds and is striving to return to consciousness. See *Psychotherapy and Psycho-analysis*.

Underground Railways and Subways. The system of traction on these is commonly electrical, because of its great cleanliness and its freedom from smoke. In Glasgow a continuously moving steel rope running on guide pulleys is used for propulsion. An effective grip on the rope is provided by a screw-controlled clamp worked from the driver's car. The transmission losses in such a system must be very great compared with those of an electrical scheme. The electrical system has also the advantage of giving a very rapid acceleration. The control of the electricity is similar to that commonly used in electric tramways, but both conductor and return take the form of a rail track. In London the systems have been linked up, so that travel is possible from one end of the city to the other, and the journey may be broken at many junctions to admit of travel on the other lines. It is thus unnecessary to come back to the surface until the end of the journey.

Undershot Wheel, a form of water-wheel with float-boards or vanes fixed to its circumference, and rotated by a stream of running water acting upon it at its lowest point. By the improvements effected by Poncelet in the form of vanes, the efficiency was more than doubled. The water never fills the space between the vanes, and the action is a pure impulse.

Un'dine, a water-spirit of the female sex, resembling in character the sylphs or spirits of the air, and corresponding somewhat to the naiads of classical mythology. According to Paracelsus, who describes the undines in his *Treatise on Elemental Spirits*, when an undine married a mortal and bore a child she received a soul. One of these spirits is the heroine of a celebrated romance by De la Motte Fouqué (*Undine*, published in 1811).

Undue Influence, English legal term. If between two persons there is a confidential relationship such as to give the one a position of influence over the other, the law will not allow the former to retain any gift or legacy from the latter unless he can show that at the time it was made the donor had proper independent advice and was " a free agent, capable of exercising an independent will ", or unless the gift or legacy can fairly and reasonably be " accounted for on the ground of friendship, relationship, charity, or other ordinary motives ". Certain relationships, e.g. those of solicitor and client, guardian and ward, doctor and patient, priest and penitent, &c., raise a presumption of influence, and in any such case the burden of proving the validity of the gift or bequest is on the recipient, in whom the influence was vested.

The term ' undue influence ' is also applied to any compulsion used towards electors to force them to vote or to abstain from voting for any particular candidate. Under the Corrupt Practices Act severe penalties are enacted, while if a candidate guilty of such practices is elected, he loses his seat and is debarred for ever from representing that constituency.

Unemployment. The British National Insurance Act defines a man as unemployed when he cannot obtain work (1) otherwise than in a situation vacant on account of a stoppage of work due to an industrial dispute; (2) in the district where he was last employed, otherwise than on conditions less favourable than he habitually obtained in his usual employment; or (3) in any other district, otherwise than on conditions less favourable than those generally obtained in such district. It will be observed that since the Act applies only to trade unionists, this definition is only applicable to the unemployed among that section of the community. General unemployment is broadly attributable to cyclical fluctuations in trade. The causes of these fluctuations are obscure, and they are the subject of controversy among economists, but their existence is indisputable. Trade has hitherto been subject to periodic booms, followed by slumps. At the top of the boom, there is practically no unemployment; at the bottom of the slump, it is severe. Apart altogether from this *general* unemployment arising from cyclical fluctuations in trade, unemployment arises in particular trades from a variety of causes. (1) In seasonal industries affected by weather and fashions, such as the building, furriers', and confectionery trades. (2) In industries which depend largely upon casual and unskilled labour, such as work in the docks, constructional work, and certain branches of the iron and steel industries. Employment under these circumstances attracts a number of casual labourers often greatly in excess of its requirements, except in times of unusual pressure. (3) In trades and industries which are in process of modification by the development of new inventions, when hand labour is replaced by machinery. The classic example of unemployment caused in this way is that of the displacement of the hand-loom weavers by the power-loom. In the long run, of course, an increase in the efficiency of industry, whether it is due to the introduction of machinery or to any other cause, tends to benefit the whole community, including the working classes; but very great temporary distress may be occasioned thereby. (4) Finally, unemployment is occasioned by maladjustments in industry, as, for instance, when the shipbuilding trade gets ahead, in the production of ships, of the demand for ocean carriage. It is thus quite possible to have serious unemployment in one industry while the general condition of trade is flourishing.

Apart from sporadic provision of relief work, no serious attempt was made to deal with unemployment in this country until the passing of the Labour Exchanges Act, 1909, and the National Insurance Act, 1911. The former set up employment exchanges, of which there were 425 by Feb., 1918, for the registration of those seeking employment, and of existing vacancies. The second part of the latter Bill made provision for the compulsory insurance against unemployment of 2,250,000 work-people on a contributory basis. This was extended by the Insurance Act of 1920 to practically the whole field of employment covered by the trade unions.

Ungava, a northern district of the province of Quebec, Canada, to which it was annexed in 1912 contemporaneously with the extension of Manitoba northwards to the 60th parallel of latitude, and of Ontario to the shores of Hudson Bay. It is bounded in the south by East Main River, Fox Lake, Ashwanipi Lake, and Hamilton River; on the east by Labrador (a Newfoundland possession); west by Hudson Bay; and north by Hudson Strait and Ungava Bay (with Akpatok Island). The total area prior to annexation was about 354,960 sq. miles.

Ungulata, the ungulate or hoofed order of mammals. It is subdivided into the following ten sub-orders, of which those marked * are only represented by extinct types. (1) *Condylarthra. Small American and European forms from the Eocene. Mostly plantigrade, with five digits to each extremity. The best-known type is the swamp-dwelling Phenacodus, possibly ancestral to horses, &c. (2) *Amblypoda. Large semi-plantigrade Eocene forms, originating in the New World and afterwards spreading into Europe. The feet and toes were short and stumpy. Dinoceras was a huge form possessing three pairs of horns. (3) *Ancylopoda. Large Miocene and Pliocene types widely distributed through Europe, Asia, and North America. The toes were sharply pointed, and five were present on each foot. Chalicotherium, Macrotherium. (4) *Typotheria. Rather small forms with complete clavicles, from the Tertiary of South America. Typotherium. (5) *Toxodontia. Large three-toed forms from the South American Miocene and Pleistocene. Toxodon, Nesodon. (6) Proboscidea. Elephants, including many extinct types, some of which form an evolutionary series. (7) Hyracoidea. The coneys of Africa, Arabia, and Palestine. Hyrax. (8) Perissodactyla. Third digit well-developed, and an odd number of toes on hind foot. Tapir, rhinoceros, horse. (9) *Litopterna. Forms somewhat resembling perissodactyles, from Middle Tertiary and Pleistocene of South America. Digits one to five (generally three), of which the third is dominant. Proterotherium, Macrauchenia. (10) Artiodactyla. Even-toed forms, with dominant third and fourth digits. (*a*) Non-Ruminantia. Hippopotamus and swine. (*b*) Ruminantia. Chevrotains; camel and llama; deer; giraffe and okapi; antelopes, oxen, sheep, and goats.

Uniats, a term applied to the Eastern Christians who have been united to Rome, but have been allowed to retain their local ecclesiastical customs, liturgies, and manner of worship. Since 1204 the Popes have frequently made efforts to extend their sway over the Greek Churches and to unite them to the Church of Rome, and in 1596, at the Synod of Brest, the Roman delegates were successful in persuading the Ruthenian clergy to accept the union. The clergy of the Uniat Churches are allowed to marry, and they use leavened bread in the Eucharist. The Uniat Churches are divided into: (1) Armenian, (2) Coptic, (3) Ethiopian, (4) Greek (Græco-Roumanian, Græco-Ruthenian, and Græco-Bulgarian), and (5) Syrian (Maronites, Chaldæans, and Malabar-Christians). The largest of these Churches is the Ruthenian, numbering about 4,000,000 adherents. There are Uniat patriarchates at Jerusalem, Antioch, and Cilicia.

Unicorn, a fabulous animal represented as with one horn growing from its forehead. Such an animal is frequently mentioned by Greek and Roman writers, who generally describe it as a native of India, of the size and form of a horse, the body being white, and a straight horn growing from its forehead. The *reem* of the Hebrews, of which *unicorn* is a mistranslation (*Deut.* xxxiii, 17, and elsewhere), was probably a urus. It was a two-horned animal. The unicorn is one of the supporters of the royal arms of Great Britain, in that posture termed *salient*. It was taken from the arms of Scotland, which had two unicorns as supporters.

Union, or Tokelau Group, a British group of coral atolls in the Pacific Ocean, forming part of the Gilbert and Ellice Islands Colony (formed between Nov., 1915, and Feb., 1916). The chief islets of the group are Oatafu (Duke of York), Fakaofo (Bowditch), Nuku Nono (Duke of Clarence), and Swain Island, a detached atoll lying farther south. The people (about 1000) are of Polynesian extraction, and their language is closely related to that of the Ellice Islands. Copra is exported. Area, 7 sq. miles.

Union, La, a town of Murcia, Spain; served by the Cartagena-Los Blancos Railway. It is the metropolis of an iron and manganese ore-mining region, where argentiferous lead is also worked. Pop. 31,000.

Union, La, a department of Salvador, Central America, producing gold and silver. The capital, La Union (San Carlos de la Union), is an important seaport on the Bay of La Union, an arm of the Gulf of Fonseca, and lies at the base of Conchagua volcano (6000 feet). It has an active trade, and is served by rail to San Miguel (40 miles). Pop. 15,000.

The San Miguel line is a part of the east-to-west railway system that forms the backbone of Salvadorian communications, and is continued to Coujutepeque, via San Vicente. From Sonsonate (q.v.), Santa Ana and San Salvador City are served. La Ceiba is reached via Ateos, and Santa Tecla and La Libertad via Nueva San Salvador.

Union Fabrics are textile fabrics made of a mixture of different materials, as cotton and wool, cotton and silk, and similar mixtures. A union fabric usually has the warp yarns made from one kind of fibre, and the weft yarns from another.

Unit. See *Weights and Measures.*

Unitarianism. As descriptive of a particular form of religion, the word 'Unitarian' was, so far as is known, used for the first time in a decree of the Transylvanian Diet, at Lecsfalva, 25th Oct., 1600, and was ratified by the Transylvanian Unitarians, as the official designation of their Church, at the Complanatio Deesiana in 1638. Seventy years earlier, in 1568, Francis David had pleaded the cause of religious liberty at the Diet of Torda; he it was who became the first bishop of what was to be known as the Unitarian Church of Transylvania and, after 1848, as the Hungarian Unitarian Church.

It was in 1565 that the Polish Anti-Trinitarians became known as the Minor Church, of which the synods, from 1601, met annually in the town of Cracow, where Faustus Socinus had come to reside in 1579. He became the virtual leader of the Polish Anti-Trinitarian community, and from him derives the epithet 'Socinian', which for two centuries and a half was used as a term of opprobrium by those who aimed at vilifying unitarianism; it has also been used by historians as sufficiently indicating the beliefs of English Unitarians, in spite of the fact that, for the most part, English Unitarian thought, whatever stimulus it may have received in its earlier stages from the widespread influence of the Socinian writings, has never more than very partially identified itself with the doctrines of Socinus. In the year 1660 the Churches of the Polish Brethren (as the Anti-Trinitarians came to be called) were proscribed; always they had been the butt of Jesuit intrigue, and when John Casimir, who had been a cardinal, became King of Poland the extermination of the Minor Church was a foregone conclusion.

In England, in the year 1640, a canon of the Convocation of Canterbury provided for the excommunication of printers, importers, and readers of Socinian books, and in 1648 an ordinance of the Long Parliament made the denial of the Trinity a capital crime. But for the intervention of Cromwell the extreme penalty would have been paid by Paul Best (1590–1657), a direct convert to the anti-trinitarianism of Eastern Europe, and John Biddle (1616–62), who was a Unitarian before he knew the Socinian writings, many of which he afterwards translated into English.

A *Brief History of the Unitarians, called also Socinians* appeared in 1687. Although published anonymously, it is known to have been written by Stephen Nye (1648–1719), a Hertfordshire vicar. At this time the Anti-Trinitarian controversy was being carried on within the Established Church. Thomas Firmin (1632–97), an intelligent philanthropist and one who maintained his communion with the Church, was largely responsible for the cost of issuing the three volumes of Unitarian tracts which came out between 1691 and 1697. Three more volumes were issued after his death. The Toleration Act of 1689 had excluded from toleration anyone who preached or wrote against the Trinity, whilst a Parliamentary Act of 1698, happily never enforced, made the denial of the Trinitarian doctrine a penal offence. The death of Firmin in 1697 stayed the promoting of his plan for the creating of 'Unitarian congregations' as fraternities within the Established Church.

Three-quarters of a century was yet to elapse before there appeared a distinctively Unitarian worship destined to establish itself as a definite part of the religious life of this country. There intervened what has come to be described as the Arian movement, of which, during the eighteenth century, the literary output was considerable. Of all the books and tracts issued the most memorable was Clarke's *The Scripture Doctrine of the Trinity.* Samuel Clarke was a clergyman of the Established Church, but his writings had a widespread influence among dissenting ministers, who now became the most conspicuous exponents of an anti-trinitarianism which, whilst denying the deity of Christ, yet gave to Him an indefinitely more exalted station than had been conceded in the scheme of Socinus. A very numerous portion of the congregations of the old dissent went through a period of heterodoxy, and in some of these the lapse from orthodoxy became permanent, and by the end of the eighteenth century or the first decade of the nineteenth they had become Unitarian, accepting, under the influence of the writings of Nathaniel Lardner (1684–1768), Paul Cardale (1705–75), Joseph Priestley (1733–1804), and others, the humanitarian view of the person of Jesus. Characteristic of the Arians and their Unitarian successors was their advocacy of the principle of intellectual freedom, their denial that salvation depends on doctrinal agreement, their emphasis on the practical aspects of Christianity, and their pioneer work in critical methods of studying the Bible.

Towards the end of 1773 Theophilus Lindsey attempted to "gather a Church of Unitarian Christians out of the Established Church". Priestley, one of the most eminent of the scientists of the eighteenth century, was well to the front among the dissenters; Lindsey, however, conceived his mission to be to members of the Church of England, and hoped for a considerable Unitarian secession. In April of 1774 he opened his Unitarian chapel in Essex Street, but for the most part it was dissenters who supported this new move; there was, however, a considerable secession of Cambridge divines.

During the half-century leading up to the year 1825, when the British and Foreign Unitarian Association was formed by the bringing together of the then existing Unitarian agencies for propaganda and missionary work, there went on, slowly but surely, the growth and consolidation of the Unitarian movement in Great Britain, although it was not until July, 1813, that the Trinity Act repealed the exclusion from toleration of those who preached or wrote against the doctrine of the Trinity, and finally removed even the possibility of anyone being penalized for disseminating Unitarian views.

In 1825 the American Unitarian Association came into being in Boston, Mass.; American unitarianism grew out of a revolt against the extreme tenets of Calvinism, and was no less concerned to deny the doctrines of human depravity and predestination than to reject the doctrine of the deity of Christ. The name of Channing is associated with this early phase of the movement, which was largely confined to the New England States.

For Lindsey the essential doctrine of unitarianism was that religious worship is to be addressed only to the One True God, the Father; he utterly condemned the worship of Christ. The Arian dissenters, whilst emphasizing the supremacy of the Father, varied in their estimate of the person of Christ, believed in His pre-existence, and regarded Him as an exalted Being essentially different from other men; this school of doctrine had by 1825 given way almost entirely to the humanitarian view, which recognized no *essential* difference between Jesus and the rest of humanity.

During the course of the nineteenth century Unitarian thought received significant modifications; the old supernaturalism and dependence on an external revelation, shown in an intense Biblicism, was gradually given up, and the seat of authority in religion was found to be in the spirit of every earnest inquirer and nowhere else. The first steps along the newer way were made clear by such leaders as John James Tayler (1797–1869), John Hamilton Thom (1808–94), and James Martineau (1805–1900), in England, whilst similar service was done in the United States by those, more particularly, who were associated with the so-called Transcendentalist movement—Emerson, Parker, Hedge, and others.

There are, in Great Britain, some 350 congregations commonly regarded as Unitarian. These churches are for the most part managed congregationally. In Northern Ireland there are some 35 Unitarian congregations and a few mission stations governed by the General Synod of the Non-Subscribing Presbyterian Church of Ireland. These congregations seceded from the orthodox Presbyterian Church in 1830. Most of the members individually profess and call themselves Unitarians, but the Church is known as the Non-Subscribing Presbyterian Church. Its members are slightly more conservative than the Unitarians in Great Britain. There are nearly 500 Unitarian congregations in the United States; there are also a few in Canada.—BIBLIOGRAPHY: G. Bonet-Maury, *Early Sources of English Unitarian Christianity*; Alexander Gordon, *Heads of English Unitarian History*; *Addresses: Biographical and Historical*; W. G. Tarrant, *The Unitarian Movement*; J. E. Carpenter, *James Martineau*; G. Willis Cooke, *Unitarianism in America.*

United Free Church of Scotland, The, is the product of the fusion of various organizations the members of which had from time to time broken away from the Church of Scotland.

Established by Act of Parliament, this latter Church always contained two opposing parties: one which favoured the controlling policy of the State, and an evangelical element which contended for liberty of jurisdiction within its own spiritual sphere. The former acquiesced in the encroachments made upon their freedom of worship and government; the latter resented and resisted the innovations, and rather than submit they seceded and founded independent denominations. So steady was the movement in this direction that by 1765 over 10,000 persons had left the Church of Scotland. The agitation for a polity untrammelled by State interference continued within the Church, and culminated in the disruption of 1843, when several hundred ministers relinquished their livings and formed themselves into the Church of Scotland Free. These claimed to carry on the true historic Presbyterian Church, purged of its evils, for the legitimacy of association with the State was not then questioned. The tendency of the smaller outside bodies, however, was towards voluntaryism, and by 1847 most of them had coalesced into the United Presbyterian Church. Two main streams of religious thought and activity thus ran parallel with the Church of Scotland: the United Presbyterian Church, which became noted for its missionary zeal, and the Free Church, which, well organized and liberally supported, developed into a powerful force throughout the country. The very success of the Free Church tended to weaken the old conception of the value of a State connection, and it was only a question of time before these two Churches approximated sufficiently to make organic union practicable. This occurred in 1900, the name assumed being the United Free Church of Scotland. It was a notable event in the religious history of Scotland, for, apart from the fact that it signalized the closing up of ancient divisions, it was marked by the dramatic and, for a time, successful claim of a small minority in the Free Church to the entire funds and property of that Church, a matter that had ultimately to be adjusted by Act of Parliament. The process of evolution towards a national, but not privileged, State Church was not exhausted, both the Church of Scotland and the United Free Church next exploring the possibilities of reunion. Subject to its fundamental principles being safeguarded, the latter expressed its willingness to rejoin the old reformed Kirk, and so to realize that dream of a great free Presbyterian Church which has been cherished for many generations. Legislation in that direction followed.

For a religious body depending for its strength and support on the loyalty and goodwill of its members the record of the United Free Church is very high. Largely by means of its Central Fund, it covers the whole of the mainland and islands of Scotland with a network of agencies ministering to the moral and spiritual needs of the people. It has over 1500 congregations, stations, and missions, with a membership of 528,000, and a total income of £1,500,000. Its three colleges have a world-wide reputation for theological culture. During the European War 198 ministers acted as chaplains, and the Church's tents and huts rendered good service in the fighting areas. In the foreign field it has the care of 35,000,000 non-Christian people in Arabia, Africa, India, China, and the West Indies; its Livingstonia mission was the pioneer enterprise on Lake Nyasa, and opened up Central Africa to trade and commerce. Two large additional spheres, on the Gold Coast and in Tanganyika Territory, were undertaken at the request of the British Government. Its overseas European staff, including those engaged in Jewish and Continental work, numbers 480, and the native agents 5000. Of late years the Church has shown increasing vigour in dealing with social and other questions affecting the material welfare of the community.

United Presbyterian Church, the name adopted by that Scottish Church which was formed by the union of the Secession Church and the Relief Church in May, 1847. The system of Church government differed from that of the Established and Free Churches only in having no intermediate court between the presbyteries and the supreme court, the latter of which was called a General Synod, and sat once a year. The distinguishing feature of the United Presbyterian Church was that it was a voluntary Church, setting itself against all establishment or endowment of religion by the State. In 1900 it joined the Free Church to form the United Free Church of Scotland.

The Secession Church was founded by Ebenezer Erskine (q.v.). It soon broke up into two sections, Burghers and Anti-burghers. In 1799 each of these bodies divided into two, known as the Auld Lichts and the New Lichts. The Auld Lichts are still represented by the Synod of United Original Seceders. The Relief Church originated in 1761, the most noted among its founders being Thomas Gillespie, who had been deposed from the ministry of the Church of Scotland on account of his attitude on the question of patronage.

United Provinces (*of Agra and Oudh*), a province of British India, comprising the two divisions of Agra (area, 83,198 sq. miles; pop. 33,209,200) and Oudh (area, 23,966 sq. miles; pop. 12,167,000), with a total area of 107,164 sq. miles; pop. 45,376,200.[1] Physically, about

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[1] The native states of Rampur and Garhwal (Tehri) are subject to the United Provinces, but are not included in the area, &c., given here. For particulars, see these articles.

54,000 sq. miles, or more than half of the province, is part of the Gangetic Plain. In the southern districts the plain merges in rugged spurs of the Vindhya Mountains, and bounding it on the north is a submontane region lying between the Ganges and the Sarda. North of the Sarda lies the Central Himâlaya, a region of waste and desolation rather than of beauty and grandeur. The whole of the province drains to the Ganges, which traverses it and divides it in two. Among other streams the Jumna and Gogra are important. Hindus form about 80 per cent of the population, and Muslims about 14 per cent. Among the former the chief castes are Châmar, Brahman, Ahîr, and Rajput. The chief language is Urdû (Hindustani), which is also the official tongue, but over a million people living in the hills speak the Central Pâhari dialect. Production is largely agricultural, and is dependent upon the soil and rainfall. In the Himâlaya the valley alluvium is cultivated in suitable places, and the other two soils, namely, the Central Indian alluvium (derived from the denudation of the Central Indian Plateau) and the main alluvium of the plain, produce good crops. Staple food-grains, such as rice, wheat, gram, barley, *sorghum*, and maize, are largely raised. Among oil-seeds the chief is *til* (sesame), but the linseed and castor (grown chiefly as a border to sugar-cane) are also widely cultivated. Cotton is the chief fibre; the opium poppy is produced as a winter crop, and sugar-cane is of great importance. Fruits include the mango, guava, plantain, fig, melon, orange, lime, citron, and custard-apple. Oil-seeds are exported to Calcutta, &c., raw cotton to Bombay, &c., for shipment abroad; grain and pulse, opium, sugar (to Rajputana, Central India, Bengal, &c.), and *ghee* (to Calcutta, Rajputana, &c.) are also exported. See *Rohilkhand* (also known as Bareilly Division). Two great trunk lines of the Oudh & Rohilkhand and the East Indian Railways serve the province, which is covered by a network of branch and other lines. Towns include Agra, Allahabad, Bareilly, Benares, Cawnpore, Lucknow, and Meerut.

United States of America, a Federal Republic, occupying the whole of the central portion of North America. *Area and Population.*—The Republic is composed of 48 states, and one district (Columbia), besides Alaska and various dependencies. The first census was taken of the thirteen original states in 1790, when the population numbered 3,929,214; the total population in 1920 was 105,710,620,[1] exclusive of the noncontiguous territory as follows:

Division.*	Gross Area, sq. Miles.	Population (approx.).
Alaska (1867) ..	590,884	55,000
Guam (1899) ..	210	13,200
Hawaii (1898) ..	6,449	256,000
Panamá Zone (1904)	527	22,900
Philippines (1899) ..	115,026	10,350,000
Porto Rico (1899) ..	3,435	1,300,000
Samoa (1900) ..	77	8,000
Virgin Islands (1917)	132	26,000
Total	716,740	12,031,100

* The figures in brackets are the dates of acquisition.

In 1860 there were 4,520,784 Negroes, of whom 3,953,760 were slaves. In 1920 there were 10,889,705 coloured people, all, of course, free. Nationalities include:

Europe:	
Ireland	1,040,000
England	813,000
Scotland	254,500
Wales	67,000
Germany	1,686,100
Italy	1,610,100
Poland	1,140,000
Russia	1,400,000
Asia:	
Syria	51,900
Armenia	36,500
Turkey	9,000
America:	
Canada	1,118,000
Mexico	478,000
Newfoundland	13,200
Australia	10,800

Between 1820 and 1920, 33,630,104 immigrants were admitted:

Year.	Total Immigrants.	From United Kingdom.
1918	110,618	2,847
1919	141,132	7,271
1920	430,001	48,062
1921	805,228	79,577

The total area of the United States, apart from noncontiguous territory, is 3,026,789 sq. miles, of which 2,973,774 miles represent land area. Articles on each of the following 48 states should be consulted: Alabama (Ala.), Arizona (Ariz.), Arkansas (Ark.), California (Cal.), Carolina North (N.C.)*, Carolina South (S.C.)*, Colorado (Col.), Connecticut (Conn).*, Dakota North (N. Dak.), Dakota South (S. Dak.), Delaware (Del.)*, Florida (Fla.), Georgia (Ga.)*, Idaho, Illinois (Ill.), Indiana (Ind.), Iowa (Ia.), Kansas (Kan.), Kentucky (Ky.), Louisiana (La.), Maine (Me.), Maryland (Md.)*, Massachusetts (Mass.)*, Michigan (Mich.), Minnesota (Minn.), Mississippi (Miss.), Missouri (Mo.), Montana (Mont.), Nebraska (Neb.), Nevada (Nev.), New Hampshire (N.H.)*, New Jersey (N.J.)*, New Mexico (N. Mex.), New York (N.Y.)*, Ohio (O.), Oklahoma (Okla.), Oregon (Oreg.), Pennsylvania (Pa.)*, Rhode Island (R.I.)*, Tennessee (Tenn.), Texas (Tex.), Utah, Vermont (Vt.), Virginia (Va.)*, West Virginia (W. Va.), Washington (Wash.), Wisconsin (Wis.), Wyoming (Wyo.). The asterisk (*) indicates one of the original thirteen states of the Union; and the bracketed letters are the official contractions of the state names. The District of Columbia is contracted to D.C.

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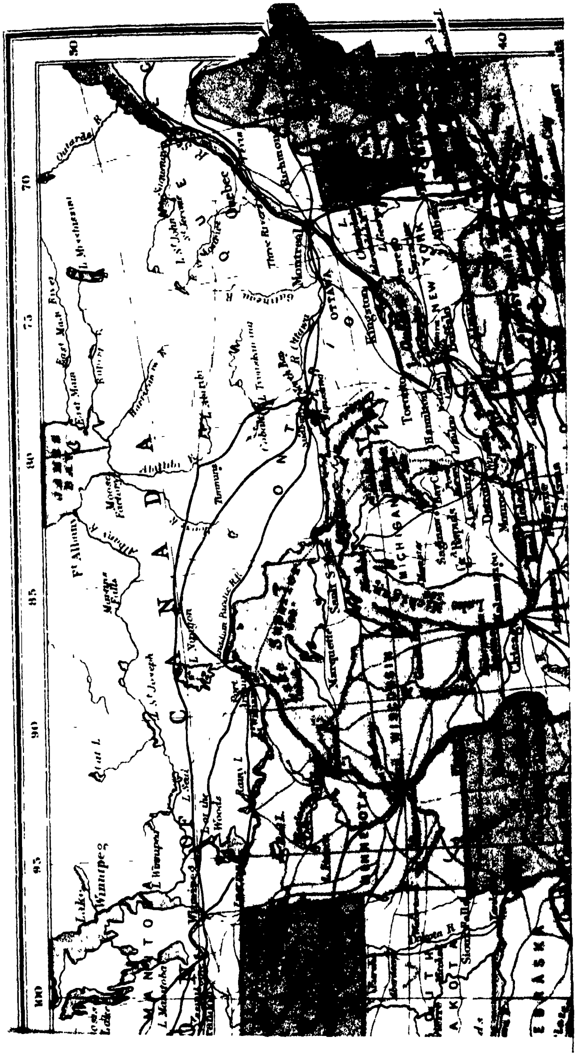
[1] Divided into religions, there are roughly 75,000,000 Protestants, 18,000,000 Roman Catholics, 1,600,000 Jews, 600,000 Mormons, and 400,000 Eastern Orthodox. The foreign-born population amounted in 1920 to 13,900,000 (approximately), of whom nearly 11,900,000 were Europeans, 1,727,000 Americans, and 240,000 Asiatics.


100
95
90
85
80
75
70
60
40
CANADA
ONTARIO
QUEBEC
MANITOBA
James Bay
Lake Winnipeg
Winnipeg
L. Manitoba
Lake of the Woods
Rainy L.
L. Seul
L. St Joseph
L. Nipigon
Ft Albany
Moose Factory
Abitibi R.
L. Abitibi
East Main
East Main River
Rupert R.
L. Mistassini
L. St John
Outardes R.
Gatineau R.
Quebec
Three Rivers
Montreal
Ottawa
Kingston
Toronto
Hamilton
Richmond
Marquette
Sault Ste Marie
Lake Superior
MICHIGAN
WISCONSIN
NEW YORK
DAKOTA
NEBRASKA
Dakota R.

General Features.—The Republic has a coast-line of 15,600 miles, of which 6861 are on the Atlantic, 2281 on the Pacific, and 5750 on the Mexican Gulf. The most important indentations on the Atlantic are Massachusetts Bay; Long Island Sound, and in connection with it the Bay of New York; Delaware Bay; Chesapeake Bay; Albemarle and Pamlico Sounds; and the Gulf of Mexico. The Pacific seaboard is deficient in bays, but possesses in that of San Francisco, on the coast of California, one of the largest natural harbours in the world. There are few islands either on the Atlantic or Pacific coasts, the only one of any importance being Long Island. The country is traversed by two great mountain-systems. The chief of these is what as a whole may be called the Cordilleras, which enters from Mexico, stretches northwards, and is continued into the Dominion of Canada. It has in its broadest parts a breadth of 1000 miles, and includes the ranges known as the Rocky Mountains, Sierra Nevada, Cascade Range, the Coast Ranges, the Blue Mountains, and various lofty plateaus. The great feature of this system is the Rocky Mountains (q.v.). The other mountain-system is the Appalachian, which stretches parallel to the Atlantic coast almost from the Gulf of Mexico to the St. Lawrence. It consists of a long plateau with various groups and ranges of hills, among which are the White Mountains in New Hampshire, the Green Mountains of Vermont, the Adirondacks of northern New York, the Catskills of south-eastern New York, and the Alleghanies of Pennsylvania. The great plain lying between these two mountain-systems belongs almost entirely to the basin of the Mississippi-Missouri, which enters the Gulf of Mexico. This, the chief river of the country, has a drainage basin of 1,257,457 sq. miles, and is of immense importance as a highway of internal trade. Various other rivers enter the Mexican Gulf, including the Rio Grande del Norte, which separates the States from Mexico. About 644,000 sq. miles of country is drained to the Pacific, 490,000 to the Atlantic, and 1,684,000 to the Gulf of Mexico (the Mississippi-Missouri being included). The country west of the Rocky Mountains, belonging to the basin of the Pacific, is drained by the Columbia in the north-west; the Sacramento, which discharges into the Bay of San Francisco; and the Colorado, which falls into the Gulf of California. Between the Alleghanies and the Atlantic the principal rivers are the Hudson, which contributes to form the harbour of New York; the Delaware, which falls into the bay of that name, and is navigable to Philadelphia; the Potomac, which falls into Chesapeake Bay, and is navigable to Washington; and the Savannah, which enters Savannah Bay. The chief lakes are Superior, Michigan, Huron, Erie, and Ontario, lying between the United States and Canada, and belonging (except Michigan) partly to both, with Lake Champlain, and Great Salt Lake. There is a coast-line of over 3600 miles to the Great Lakes.

Geology and Minerals.—Geologically the United States roughly forms two large areas. One extends from the Atlantic to the base of the Rocky Mountains, and is occupied to a large extent by a great basin of Palæozoic formations, including the Cambrian, Silurian, Devonian, and Carboniferous divisions. In the other great geological area, which extends from the base of the Rocky Mountains to the Pacific, the Eozoic and Palæozoic formations which predominate are overlaid by rocks of the Secondary and Tertiary periods. The United States is the greatest producer of minerals in the world. Coal of all kinds and iron are the chief products. It stands first in the output of coal, copper, iron, lead, petroleum, and salt; only Mexico produces more silver, and only Germany more zinc; and it is one of the chief gold-mining countries. The only notable metal not among its resources is tin. Of its annual output of coal fully one-fifth is anthracite. The anthracite comes almost wholly from Pennsylvania, which is also the chief producer of bituminous coal and altogether the principal mining state of the Union. Other notable producers of bituminous coal are Illinois, West Virginia, Ohio, Alabama, Indiana, Kentucky, Iowa, Kansas, and Missouri. About three-fourths of the total output of iron ore is obtained from a number of low ranges of hills near Lake Superior, in Minnesota and Michigan. The ore is smelted chiefly in Pennsylvania, Ohio, and Illinois, where fuel is abundant. Montana, Michigan, and Arizona produce the bulk of the copper; lead comes principally from Idaho, Utah, and Colorado; zinc is mined in Kansas, Missouri, Arkansas, Illinois, and other states. Gold comes chiefly from Colorado, California, and South Dakota, and silver is produced, mainly in Colorado, Montana, Idaho, and South Dakota. The leading petroleum states are California, Ohio, Texas, West Virginia, Pennsylvania, Indiana, and New York; and natural gas, a valuable fuel, is produced in several states. Other minerals worthy of mention are granite, marble, phosphate rock, salt, quicksilver, aluminium, antimony, platinum, nickel, cobalt, manganese, graphite, gypsum, limestone, borax, asbestos, talc, and mica. Some precious stones are also obtained.

Climate, Flora and Fauna.—The United States, stretching over such a vast area and having such great tracts of mountain and plain, must necessarily present a great variety of climate. The mean annual temperature ranges from under 40° to 75°. The isotherm of 55° mean annual temperature crosses the centre of the country from east to west, passing through St. Louis. Places in the latitude of New York and Chicago have nearly the same mean temperature for the year as the British Islands. The mean annual rainfall for the whole country is about 30 inches, but there is a great difference in this respect between different parts. The rainfall is most abundant on the north-west Pacific coast, on the Gulf coast, and on the high mountain ranges. On the Great Plains it is only 10 to 20 inches, and there are large desert stretches in the Rocky Mountain region with a rainfall of less than 10 inches. The distribution of forests is partly determined by rainfall. East of the Great Plains the country is well wooded, but the Great Plains themselves and great part of the mountain region are almost treeless. In Washington, Oregon, and northern California there are extensive forests of valuable conifers, including pines, red-wood, and sequoias. The principal trees of the east are white pine, now becoming scarce, yellow pine in several varieties, walnut, chestnut, oak, poplar, cherry, spruce, balsam, and hemlock. Lumbering is a flourishing industry in the Pacific forest region and around the great lakes chiefly. There is wide variety in the vegetation, which is semi-tropical in the south and has a semi-arctic character in the north. The western deserts are characterized by cactuses, the yucca, and the sage brush. Among the principal native animals, some almost exterminated, are antelopes, deer, bears, bison or buffalo, the American elk, the big-horn or Rocky Mountain sheep, the Rocky Mountain goat, prairie dogs, coyotes, wolves, opossums, and jack rabbits. The rattlesnake and other snakes are notable among reptiles.

Agriculture.—The total area occupied as farms in 1922 was 955,890,000 acres approximately, of which 503,100,000 acres were improved land. The number of farms was 6,450,000. The most numerous class of farms is that between 100 and 500 acres, next that between 20 and 50 acres. The great majority of farms were cultivated by owners. Irrigation is absolutely essential to agriculture in the dry central and western regions. Among cultivated crops the most important are: maize, grown in many of the central states, chiefly in Iowa, Illinois, Kansas, Nebraska, Missouri, Indiana, and Ohio; wheat, chiefly in Kansas, Minnesota, the Dakotas, Nebraska, Ohio, Pennsylvania, Indiana, Missouri, Washington, Illinois, and Michigan; oats, chiefly in Illinois, Iowa, Wisconsin, Minnesota; barley is favoured in a very few states; rye, in the north-east; buckwheat, mostly in New York and Pennsylvania; tobacco, principally in Kentucky, North Carolina, Virginia, Wisconsin, Ohio, Tennessee, Connecticut, Pennsylvania, and Maryland; rice, mostly in Louisiana, Texas, South Carolina, and Georgia; cane-sugar, in Louisiana and Texas; cotton, principally in Texas, Georgia, Mississippi, Alabama, South Carolina, Louisiana, Arkansas, North Carolina; beet-sugar, in California, Nebraska, and Utah; sorghum-sugar, in Kansas; maple-sugar, in the north-east; besides potatoes, sweet-potatoes, hay, hemp, flax, &c. Of fruits, the most noteworthy are apples, pears, plums, peaches, oranges, grapes, lemons, pineapples, and bananas. California is the chief fruit-growing state, but Florida is also of importance in this respect. Wine is made in California and other states. The canning of fruits and vegetables is an extensive industry, especially in California, New York, and Maryland. Horses are largely bred, and mules and asses in the southern states. Horned cattle and sheep are raised in great numbers, hog-rearing forms an important industry, and immense quantities of cheese, butter, and condensed milk are made. Illinois is the chief state for slaughtering and meat-packing, and New York, Wisconsin, and Iowa lead in dairying.

Fisheries.—The New England and Middle Atlantic States are the chief fishery zones. The fish taken on the Atlantic coast comprise cod, haddock, mackerel, halibut, herring, shad, whiting, mullet, bass, sturgeon, menhaden, &c., besides oysters, for which Maryland is the principal state. Washington, Oregon, and Alaska have very extensive salmon-fisheries, and export enormous quantities of canned fish. The fisheries are carefully fostered and regulated by Government.

Manufactures.—The United States is one of the greatest manufacturing nations. The principal manufacturing states are New York, Pennsylvania, Ohio, Massachusetts, and Illinois. The principal industries are the iron and steel industries, the textile industries, slaughtering and meat-packing, lumbering, flour-milling, the working of copper, lead, and other metals, tanning and the manufacture of boots and shoes, brewing, the manufacture of chemicals, factory dairying, the making of agricultural implements and all kinds of machinery. The chief centres of some of the more important manufactures are as follows: iron and steel, in Pennsylvania, Ohio, Illinois, New Jersey, Indiana, Alabama, West Virginia, and New York; agricultural implements, in Illinois, Ohio, New York, Wisconsin, Indiana, Michigan, &c.; railroad and other cars, in Pennsylvania, Illinois, New York, Ohio, &c.; shipbuilding, in Philadelphia, New York, Baltimore, &c.; cottons, in Massachusetts (Fall River, Lowell, New Bedford, &c.), the Carolinas, Rhode Island, New Hampshire, Pennsylvania, Georgia, &c.; woollens, in Massachusetts, Pennsylvania, Rhode Island, and New York; flax and linen, in New Jersey and Massachusetts; silk, in New Jersey (Paterson), &c.; slaughtering and meat-packing, in Chicago, Kansas City, Omaha, &c.; flour-milling, in Minneapolis, &c.; leather, in Pennsylvania, Massachusetts, New York, Wisconsin, &c.; boots and shoes, in Massachusetts, New York, Ohio, Pennsylvania, New Hampshire; pottery, in Ohio, Pennsylvania, and New Jersey; chemicals, in New York, Pennsylvania, New Jersey, Michigan; glass, in Pennsylvania, Indiana, New Jersey, Ohio, Illinois, New York, &c.; paper, in New York, Massachusetts, Pennsylvania, Maine, Ohio, &c.

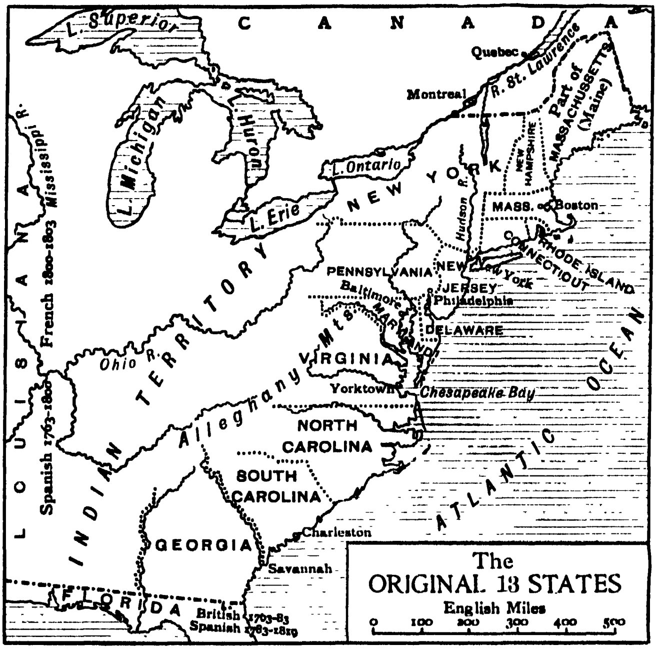
Commerce.—The principal classes of imports are raw materials, certain articles of food, and manufactured goods; the chief classes of exports are agricultural products and manufactured goods. Among commodities imported are sugar, coffee, chemicals, hides and skins, raw silk, rubber and gutta-percha, cotton goods, wool and woollen goods, silk goods, fruits, iron and steel and their manufactures, tin, tobacco and its manufactures, copper and its manufactures, furs, spirits and wines, tea, leather and its manufactures, earthenware and china, oils, fish, raw cotton, cocoa, glass, paper, &c. The principal commodities exported are raw cotton (a quarter of the total value), meat and dairy produce, iron and steel and their manufactures, grain and flour, copper and its manufactures, mineral oils, wood and its manufactures, cotton goods, animals, leather and its manufactures, tobacco and its manufactures, oil-cake, agricultural implements, vegetable oils, naval stores, chemicals, fruits and nuts, carriages and cars, paper, fertilizers, furs, rubber goods, books, sugar, glucose, &c. The principal countries imported from are: Canada, Britain, Cuba, Japan, France, China, Brazil, Mexico, Germany, Netherlands, Italy, British India, Philippine Islands, Egypt, Chile, &c. The exports are taken chiefly by Britain and Canada, who are the best customers; others are: Germany, France, Italy, Netherlands, Belgium, Mexico, Cuba, China, and Japan. Britain's principal imports from the United States are: petroleum, raw cotton, brass and copper, wheat and other cereals, wheat-meal and flour, fish, lard, beef, hams, bacon, motor-cars, chemicals, wood and timber, zinc, iron and steel, paraffin wax, and starch; and her principal exports to the United States are: linen goods, cotton goods, woollen goods, wool, jute goods, chemicals, tin, and silk. The United States has a highly protective customs tariff.

Shipping and Ports.—The foreign trade of the country, formerly carried on in foreign bottoms, is now mainly the monopoly of Federal ships. In 1922 the strength of the mercantile fleet was 27,358 vessels of 18,462,967 tons, of which 18,960 vessels of 15,982,100 tons were steamers. The Atlantic ports receive more than half of the tonnage entered. The principal seaports are: New York (nearly a quarter of the whole tonnage), Boston, New Orleans, Philadelphia, Baltimore, Galveston, San Francisco, Mobile, Pensacola, Portland (Me.), Savannah, Wilmington (N.C.), and Newport News, besides the lake ports of Detroit, Duluth, Superior, Chicago, Buffalo, &c. The principal cotton-shipping ports are: Galveston, New Orleans, Savannah, and New York; wheat is exported chiefly from Galveston, New Orleans, New York, Baltimore, and Superior; wheat-flour mostly from New York and Baltimore; New York and Boston are the chief seaports for the export of beef, bacon, and hams; petroleum is exported chiefly by New York and Philadelphia; cattle are shipped at New York, Boston, Baltimore, and Philadelphia principally; New York, Baltimore, and New Orleans are the leading tobacco ports. The coasting trade is confined by law to United States vessels.

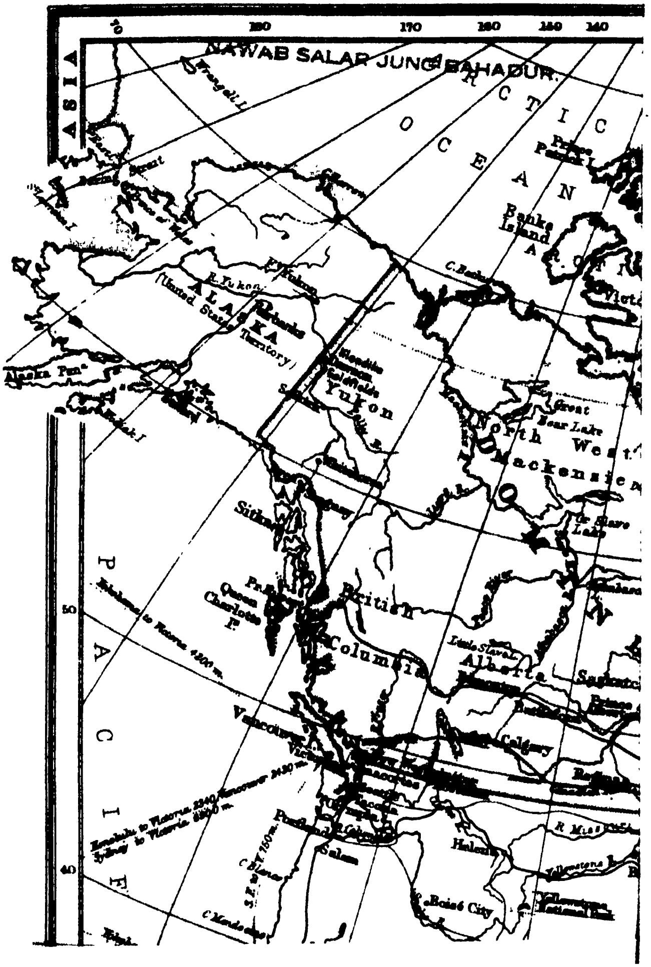
Weights and Measures, Currency, &c.—The weights and measures are the same as those of Great Britain; but the old Winchester wine gallon, equal to 0·833 of an imperial gallon, the ale gallon, equal to 1·01695 imperial gallon, and the Winchester bushel, equal to 0·9692 of an imperial bushel, are used instead of the imperial standards, and a cental of 100 lb. is used instead of the cwt. The short ton of 2000 lb. is used for many purposes. Gold is coined in double eagles = 20 dollars, eagles = 10 dollars, half-eagles, and quarter-eagles. Silver is coined in dollars, half-dollars, quarters, and dimes or 10 cents. There is a nickel 5-cent piece and a bronze cent. The par value of the dollar of 100 cents is 49·32*d.* (i.e. there are 4·8665 dollars to the £ sterling). The country is divided east to west into time zones, the time in each zone being one hour later than that in the zone to the east of it. These zones have their time described thus: *Eastern Time* (5 hours later than Greenwich), New York and Washington; *Central Time*, Chicago and St. Louis; *Mountain Time*, Denver; *Pacific Time*, San Francisco.

Constitution, Government, &c.—The government of the United States is a Federal Republic based on the Constitution of 1787, drawn up by delegates from the thirteen original states, and subsequently amended. The Constitution and modes of administration of the individual states bear a close resemblance to each other. Each state maintains its independence, and by means of a state legislature and executive (vested in a Governor) has complete management of its own affairs. The combined states have one supreme legislature, which takes the name of

Congress, and consists of a Senate and a House of Representatives. The Senate consists of two members from each state elected by its own legislature for six years, one-third of the whole body being renewable biennially. The House of Representatives consists of members chosen for two years by the people of the several states, in numbers proportioned to their population as ascertained by the decennial census. At present it is composed of 435 members. The annual salary of a Senator or a Representative is 7500 dollars, with travelling expenses. Congress meets at least once a year, and its leading powers are to levy taxes, duties, imposts, excises; to provide for the common defence and general welfare of the Union; to regulate commerce with foreign nations and among the several states; to coin money, declare war, raise and maintain an army and navy, &c. The executive is vested in a President chosen for four years, but eligible for re-election. The electors who vote for the President are chosen by each state, in such manner as its legislature may provide, and are in this capacity known as the Electoral College. The President and Vice-President are chosen by the majority of this college, and in the case of an equality of votes the President is chosen by the House of Representatives, and the Vice-President by the Senate. The President, who must be a native-born citizen, and who receives a salary of 75,000 dollars yearly plus 5000 dollars travelling allowance, has the power, in concurrence with two-thirds of the Senate, to make treaties, appoint civil and military officers, levy war, conclude peace, &c. He has even a veto on the laws passed by Congress, at least until they have received the assent of two-thirds of both Houses. The Vice-President, who has a salary of 8000 dollars, presides in the Senate, and in case of death or permanent disability succeeds the President for the remainder of the term. The business of the executive is administered by a Cabinet consisting of the Secretary of State, Secretary of War, Secretary of the Navy, Secretary of the Treasury, Postmaster-General, Secretary of the Interior, Attorney-General, Secretary of Agriculture, and Secretary of Commerce and Labour, each of whom has an annual salary of 12,000 dollars, and holds office during the pleasure of the President. The seat of the Federal Government is Washington, capital of the District of Columbia. The Judicial powers of the Union are vested in a supreme court, presided over by a chief Justice and eight associate Judges, while each state appoints its own local Judges. The state legislatures may deal with all matters not expressly reserved for the Federal Government by the Constitution of the United States or falling within restrictions imposed by the state Constitutions. Practically all criminal jurisdiction belongs to the states.

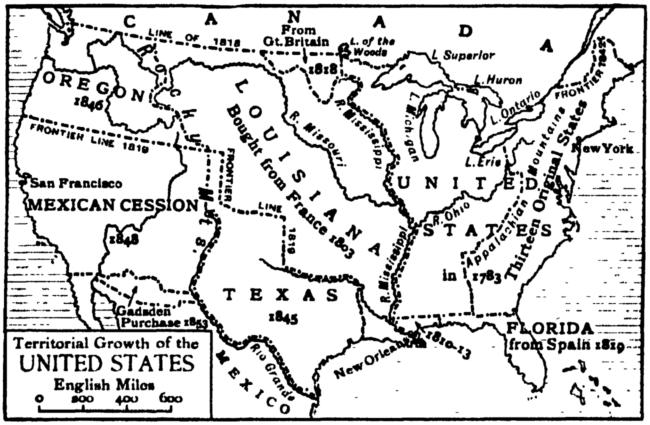

The ORIGINAL 13 STATES

History.—The first English colonies within the limits of the Union were settled by two chartered companies, called the Plymouth Company and the London Company. By the latter an expedition was sent out in 1607, and a settlement was made at Jamestown, in the present state of Virginia, while the Plymouth Company established a colony on Massachusetts Bay. Other settlers continuing to arrive, a Colonial Assembly was for the first time convened in 1619. At this time the foundation of the colonies of New England was laid by the



NAWAB SALAR JUNG BAHADUR
ASIA
180
170
160
150
140
ARCTIC OCEAN
Wrangell I.
Bering Strait
Prince Patrick I.
Banks Island
C. Bathurst
R. Yukon
Ft. Yukon
ALASKA
(United States Territory)
Fairbanks
Alaska Pen.
Kodiak I.
Klondike
Dawson
Goldfields
Yukon
Great Bear Lake
North West
Mackenzie
Gr. Slave Lake
Sitka
Queen Charlotte I.
British Columbia
Little Slave L.
Alberta
Calgary
Regina
Vancouver I.
Victoria
Vancouver
Tacoma
Portland
Salem
Helena
Boisé City
Yellowstone National Park
Yellowstone R.
C. Blanco
C. Mendocino
Yokohama to Victoria 4300 m.
Honolulu to Victoria 2340, Vancouver 2430 m.
Sydney to Victoria 6850 m.
PACIFIC
50
40

'Pilgrim Fathers', a body of Puritans numbering 100 who sailed from England in the *Mayflower*, and landed in 1620 in Massachusetts Bay, where they established themselves. Then another colony was founded in 1628 at Salem, and in 1630 still another was established in Boston. Rhode Island was first settled at Providence in 1636 by Roger Williams, who had been driven from Massachusetts for his religious and political opinions. The states of Maryland and Virginia were colonized chiefly by English Roman Catholics and Royalist refugees, while the central states were, to a great extent, settled by Dutch and Swedes. The most remarkable events of the colonial period were those connected with the wars which Great Britain and her colonies were obliged to wage with France, and which terminated in the cession of Canada, &c., to Great Britain in 1763 by the Peace of Paris at the close of the Seven Years' War.


Territorial Growth of the UNITED STATES

No sooner was this peace concluded than the British Parliament resolved to increase the revenue by a general stamp duty levied in all the American colonies. Accordingly the Stamp Act of 1765 was passed; but this, after opposition, was repealed next year, Britain still claiming, however, its right to tax. In accordance with this claim a duty, in 1767, was imposed upon tea, paper, glass, &c.; but the colonial opposition was such that three years later the duties were all repealed except the one upon tea. To such a pass had the opposition now come that in 1773, when British ships loaded with tea attempted to effect a landing in the port of Boston, a number of the inhabitants, disguised as Indians, seized them and threw the cargoes into the sea. In punishment of this, Parliament passed the Boston Port Bill, which declared that port closed to all commerce, and transferred the seat of colonial government to Salem. From this time it became evident that a conflict was inevitable, and in 1775 hostilities actually commenced when a small British force, sent from Boston to destroy the military stores at Concord, was attacked by the colonists near Lexington, and forced to retreat. Before the end of April the British Governor and army were besieged in Boston by a revolutionary force of 20,000 men; the northern fortresses of Ticonderoga and Crown Point were seized; and a Continental Congress which assembled at Philadelphia took measures to equip an army and navy, with George Washington as commander-in-chief. On 17th June the British attacked the entrenched position of the colonists on Bunker Hill, which commanded Boston harbour, and captured it, but in the following year they retreated to Halifax. This action induced the colonists to continue their resistance, and it was declared by the thirteen states assembled in congress that "the united colonies are, and ought to be, free and independent states; that their political connection with Great Britain is, and ought to be, dissolved". This resolution was embodied in a Declaration of Independence, drawn up by Jefferson and adopted 4th July, 1776. The British Government now sent an army against the colonists under the command of Sir William Howe, and in a battle on Long Island (Aug., 1776) Washington was defeated with heavy loss. He retreated beyond the Delaware, and in order to defend Philadelphia, then the capital, was obliged to give battle on the Brandywine, where he was again defeated. Fortune, however, favoured the Americans in the North, where General Burgoyne surrendered to General Gates at Saratoga in Oct., 1777. This induced the French to enter the struggle in the spring of 1778, and subsequently Spain and Holland aided the Americans. At last the surrender of Lord Cornwallis with his army at Yorktown (1781) to a combined French and American force under Rochambeau and Washington, virtually terminated the war. On 3rd Sept., 1783, Great Britain formally recognized the independence of the United States by a treaty of peace signed at Paris, and in order still further to establish their position the thirteen states met at Philadelphia in 1787, and after four months' deliberation framed a Constitution. This Constitution, which still remains the basis of the government, came into operation in March, 1789, and George Washington was elected the first President. In 1793 Washington was unanimously re-elected President, but in 1797 he refused a third term. During his administration the states of Vermont, Kentucky, and Tennessee were admitted into the Union. John Adams was elected second President, and it was while he held office that France made war upon the Republic, the fighting taking place chiefly at sea. In 1800 the seat of government was transferred from New York to Washington. In 1802 Ohio was added to the Union, and in the next year the great territory of Louisiana was purchased from France. Great Britain still claimed the allegiance of American naturalized subjects, and the right to search American vessels for British seamen. In 1807 the British frigate *Leopard* overhauled the United States frigate *Chesapeake* near the entrance to Chesapeake Bay, compelled her to surrender, and took off four of her men. Reparation was asked in vain, and in June, 1812, war was declared against Britain. In 1814 peace was arranged. After this the chief historical events were the wars against the southern Indian tribes and the acquisition of Florida from the Spanish (1819); the annexation of Texas, which led to a war with Mexico (1845); and the acquisition of New Mexico and Upper California, ceded to the United States on payment of the sum of 15,000,000 dollars to Mexico.

The insurrection (1859) at Harper's Ferry brought the question of the abolition of slavery to a crisis. The presidential election of 1860 turned to a great extent upon this question, and when Abraham Lincoln, the Republican candidate, was elected, the slave-holding states considered themselves defeated, and South Carolina, Mississippi, Florida, Alabama, Georgia, Louisiana, and Texas formally seceded from the Union. These states formed themselves into a Southern Confederation (4th Feb., 1861), with Jefferson Davis as President, and they were subsequently joined, after hostilities had begun, by Virginia, North Carolina, Tennessee, and Arkansas. The custom-houses, arsenals, and United States buildings generally were seized and occupied by the Confederates in their own states, and every preparation made to organize a separate Government. War was inevitable, and the first blow was struck on 12th April, 1861, the Confederates proceeding to bombard Fort Sumter, which was forced to surrender. The four years' war ended in favour of the Federals (see *Lincoln*; *Lee*; *Grant*; *Jackson*; *Davis*; *Slavery*). In the course of the war the abolition of slavery was proclaimed by President Lincoln, who had just entered (April, 1865) upon his second term as President when he was assassinated.

As the states returned to their allegiance to the Union they were after a time readmitted to their state and national privileges. The election of General Grant to the presidency in 1869 served, in some measure, to consolidate matters. An amendment to the national Constitution was proclaimed in March, 1870, and provided that no difference of race, colour, education, or religion shall debar any person from the rights of citizenship in any of the states. This question of equal rights as between the negro and the white population is still beset with dangers.

The Treaty of Washington (1871) provided for the settlement by arbitration of three outstanding disputes with Great Britain. One of them concerned the claims based upon the depredations of the Confederate vessel *Alabama* (q.v.); the second bore on the disputed frontier between British and United States territory in the neighbourhood of Vancouver Island; and both of these were settled in favour of the United States. The third concerned the Canadian fisheries, and was decided against the United States. President Grant was succeeded in the presidency by R. B. Hayes (1877–81), who ended the period of reconstruction in the South by withdrawing all Federal troops in 1877. At the presidential election of 1880 the Republicans elected their candidate, James A. Garfield (q.v.). In 1884 the Democrats were successful in securing the election of Grover Cleveland (q.v.). The Republican, Benjamin Harrison (q.v.), was elected President in 1888. Cleveland was again elected in 1892, and began his second term in 1893 (see *Behring's Sea*; *Seal*). In his message of 17th Dec., 1895, President Cleveland brought his country to the verge of war with Britain by claiming to interfere, on the basis of the Monroe Doctrine, in the boundary dispute between Venezuela and British Guiana, but an agreement to submit it to arbitration was reached in the following year. The presidential election of 1896 resulted in the election of the Republican, M'Kinley (q.v.). Hawaii was annexed in 1897. The Spanish-American War of 1898, arising out of the Cuban revolution, ended in a hollow defeat of Spain, and by the Treaty of Paris (1899) Spain relinquished all claim to Cuba and ceded to the United States Porto Rico, Guam, and the Philippines. The Filipinos refused to accept the cession of their islands and formed a republican government, but after desultory fighting the Union asserted its authority and established civil government (see *Taft*). The presidential election of 1900 was again won by M'Kinley. In Sept., 1901, President M'Kinley was shot by an anarchist, and his place was taken by the Vice-President, Theodore Roosevelt (q.v.).

Roosevelt's administration was marked by a considerable activity of the Federal Government against combinations in restraint of trade, and his chief activity was directed against trusts. The President consequently came into conflict with business men, and many of his policies of reform were ignored by Congress. During his administration Alaska was allowed a delegate to Congress, naturalization was made uniform, and Japanese immigration was restricted. The San Francisco earthquake occurred in April, 1906, whilst on 29th Sept. of the same year the United States intervened in Cuba and established a provisional government in the country. Roosevelt was succeeded in office by William Howard Taft in 1909. The new President immediately summoned Congress for the purpose of revising the tariff. A new protective tariff, in the interests of manufacturers, was inaugurated, and the Payne-Aldrich Tariff Act was adopted on 5th Aug., 1909. This caused considerable resentment, and a Democratic House of Representatives was elected. In 1909 the United States forces of occupation were withdrawn from Cuba, and the differences with Venezuela were settled. In 1912 New Mexico and Arizona were admitted as separate states. During the electoral campaign of 1912 three Republicans, Taft, Roosevelt, and La Follette were seeking nomination, and this split led to the victory of the Democratic candidate, Woodrow Wilson, who was elected President. The President's attention was much occupied by foreign relations. The Mexican problem was rather embarrassing, whilst relations with Japan became strained. The Republic of China was recognized by the President on 2nd May, 1913. In 1914 the European War broke out, and although America at once declared its neutrality, the United States lent money and sold munitions to the Allies. The Ship-Purchase Act, introduced by the President, was defeated, and Secretary Bryan, who was a staunch supporter of American neutrality, resigned office. Wilson was re-elected President in 1916 by 9,116,296 votes, and immediately turned his attention to the situation in Europe. The country still believed in the possibility of an early peace, but it was soon disillusioned. The President's efforts to bring about a speedy peace proved futile, and on 3rd Feb., 1917, the United States severed diplomatic relations with Germany, war subsequently being declared on 6th April (see *League of Nations*; *European War*; *Wilson*). President Wilson was succeeded in office by the Republican Harding (q.v.), who died in Aug., 1923, and was succeeded by the Vice-President, Calvin Coolidge.—BIBLIOGRAPHY: J. C. Ridpath, *History of the United States from Original Times*; J. S. Bassett, *Short History of the United States*; W. Wilson, *A History of the American People*.

Literature.—For a period of over 150 years the literature of the United States was nothing more than a colonial offshoot of English literature. The Englishmen who had colonized the American shores of the Atlantic naturally continued to follow the literary fashions of the mother-country. For the last century or more, however, the literature of the United States has been the product of an independent nation. The divergence between American and English literary productions grows wider from day to day, and American writers are more and more expressing the national American life and spirit. What distinguishes the literature of the United States from that of other nations is the fact that it had no infancy. Primitive epics and chants, myths and legends are wanting in American literature.

American literature may be divided into four periods: the colonial period (1607–1765), the revolutionary period (1765–1815), the period of national expansion (1815–37), and the modern period (from 1837 onwards).

The colonial period of American literature was not productive. History, biography, and theology were the subjects to which the writers of this period turned their attention. It was, however, poetry which marked the first awakening of the literary activity of the settlers. The first literary work of any consequence done in the United States was a translation of Ovid's *Metamorphoses* by George Sandys, written in Virginia in 1620, and published in London in 1626. The first published book was a Puritan edition of the *Psalms* (Cambridge, United States, 1640). The journals and annals of John Winthrop (1588–1649), Governor of Massachusetts; Edward Winslow (1595–1655), Governor of Plymouth Colony; Nathaniel Morton (1613–85), &c., have been valuable to the historian. The most notable of the earlier writers were theologians, such as Increase and Cotton Mather, Roger Williams, and above all Jonathan Edwards.

The succeeding or revolutionary period was one of strife and combat, and the literature produced between 1765 and 1815 was chiefly a literature of propaganda, of arguments and persuasion. Both the colonial and revolutionary periods are distinguished by a predominance of works dealing with contemporary politics and applied law over works of imagination and pure reasoning. The aim of literature was still a practical one, and *art for art's sake* was as yet unknown. In any case, the poetry and fiction produced in America during the eighteenth century did not penetrate the consciousness of Europe. The principal writers of the revolutionary period were: James Otis (1725–83), Josiah Quincy (1744–75), John Adams (1735–1826), Thomas Jefferson (1743–1826), Alexander Hamilton (1757–1804), John Jay (1745–1829), James Madison (1751–1836), and above all the statesman and scientist Benjamin Franklin (1706–90). Of historical writings belonging to this period there were the *History of New England* by Hannah Adams, of the American Revolution by William Gordon and David Ramsay, and the *Annals of America* by Abiel Holmes. Philology was represented at this time by Lindley Murray (1745–1826), and the compiler of the famous dictionary, Noah Webster (1758–1843). Among the theologians were the younger Jonathan Edwards (1745–1801), Samuel Hopkins (1721–1803), Timothy Dwight (1752–1817), Bishop W. White (1747–1836), John Murray (1741–1815), and J. S. Buckminster (1784–1812). The list of poets includes Philip Freneau (1752–1832), John Trumbull (1750–1831), and Joel Barlow (1755–1812). The first well-known novelist was Charles Brockden Brown (1771–1810).

Since the beginning of the nineteenth century the number of American writers has enormously increased, and several of them have obtained a world-wide reputation. Nearly all branches of literary art are represented by works of a more or less adequate and characteristic kind, and some new materials and forms, notably the so-called American humour, have been added to the Old-World stock.

The first American writer to become really popular on the European side of the Atlantic was Washington Irving (1783–1859), author of *Knickerbocker's History of New York* (1808). After him came James Fenimore Cooper (1789–1851), who obtained a great reputation by his novels of American-Indian and of sea life, such as *The Last of the Mohicans*, *The Red Rover*, &c. He was far surpassed by Nathaniel Hawthorne (1804–64), one of the most original writers of America, author of *The Scarlet Letter* (1850) and *The House of the Seven Gables* (1851). Henry D. Thoreau (1817–62), author of *Walden*, is at the head of a class of writers on nature. William E. Channing (1780–1842) and Theodore Parker (1810–60) were among the foremost leaders of the liberal movement in theology and religion. At the head of the so-called Transcendentalist group of writers was Ralph Waldo Emerson (q.v.).

The foremost names in American poetry are: William Cullen Bryant (1794–1878), whose works have much of Wordsworth's manner; John Greenleaf Whittier (1807–92); Henry Wadsworth Longfellow (q.v.); Edgar Allan Poe (q.v.); James Russell Lowell (1819–91), author of *The Biglow Papers* (1848); and Walt Whitman (q.v.), who boldly challenged the accepted poetical conventions, and sought to inculcate a lofty conception of democracy. Other poets are: E. C. Stedman, R. H. Stoddard (1825–1903), Richard Watson, E. A. Robinson (1869), L. V. Ledoux (1880), and Percy Mackaye (1875).

The novelists and story-writers are numerous, and many of them are much read outside of America. In addition to Washington Irving, Fenimore Cooper, and Nathaniel Hawthorne, we can only mention a few: Mrs. Harriet Beecher Stowe; Bret Harte; William D. Howells; Henry James (1843–1916), who relies much on psychological analysis; F. Marion Crawford (1854–1909); Stephen Crane (1870–1900); Gertrude Atherton; Winston Churchill (1871); Mary Johnston (1870); David Graham Phillips (1867–1911); Lew Wallace (1827–1905); Mary Noailles Murfree (Charles Egbert Craddock); Robert Herrick (1868); O. Henry (Sydney Porter); and Jack London (1876–1916). Of American humorists the best known are: Charles Farrar Browne (Artemus Ward), Henry W. Shaw (Josh Billings), Samuel L. Clemens (Mark Twain), David Ross Locke (Petroleum V. Nasby), and Peter Dunne (Mr. Dooley). Among leading American historians are: George Bancroft (1800–91), W. H. Prescott (1796–1859), J. L. Motley (1814–77), George Ticknor (1791–1871), and Woodrow Wilson (q.v.). Of American literary critics we may mention: Brander Matthews, G. E. Woodberry, James Huneker, and P. E. More. The essay was cultivated in America by Emerson, J. R. Lowell, O. W. Holmes (1809–94), G. W. Curtis (1824–92), T. B. Aldrich (1836–1907), and John Burroughs (1837–1921).—BIBLIOGRAPHY: W. P. Trent, *History of American Literature*; T. Stanton, *A Manual of American Literature*; Duyckincks, *Cyclopædia of American Literature*; *The Cambridge History of American Literature.*

University. The word 'university' means to-day a corporation of teachers and students which has a recognized power and authority to grant degrees under certain defined conditions, but the term has in itself no such significance, and, indeed, no meaning beyond that of an association. *Universitas vestra* was a phrase in common use in the Middle Ages for addressing a number of persons, and it meant no more than 'all of you'. Universitas was not the original term employed to describe what is now called a university. When the European universities originated during the twelfth-century revival of learning, the schools to which students crowded to study under the guidance of learned men were known as *studia generalia.* There were great teachers of law at Bologna, and a studium collected around them, while teachers of theology and philosophy created a studium at Paris. The movement spread, and by the latter half of the thirteenth century there was a large number of rival schools claiming the title of studia generalia, each of them divided into a number of faculties—arts, law, medicine, and divinity. Some form of definition became necessary if the term studium generale was to be preserved from losing any real significance by being applied to insignificant schools. The distinction ultimately adopted was that a studium generale must be authorized by the Pope or the emperor, who alone could confer the *jus ubique docendi*, a privilege by which a teacher licensed by one studium generale had the right of teaching in any other. This licence consisted in the conferment of the degree of doctor or master, which were at first synonymous, though the doctorate afterwards came to signify a higher degree.

The substitution of the word *universitas* for the term *studium generale* came about through the authority which was gradually acquired by associations or guilds within the studium. In Italy guilds or societies among the students, *universitates studentorum*, came, owing to local conditions in the Italian city-states, to be the governing body of the studium, the doctors or masters possessing scarcely any power beyond that of examining for and conferring degrees, and this form of constitution was followed in Spain and in parts of France. The universitas thus came to supersede studium generale as the title of the institution which it governed. In Paris and in England the ruling guild or universitas was composed not of the students but of the masters, and it similarly replaced the older name. Studium generale always occurred in Papal Bulls for the foundation of a seat of learning, but universitas was the term in actual use. A mediæval university was therefore a society of teachers and scholars, possessing an authority acknowledged all over Europe, governed by some of its own members, and granting degrees or licences to teach. The distinction between universities of students and universities of masters was most important from the twelfth century to the fifteenth, after which there were changes in the constitution of the Italian universities.

Another form of institution, known as a college, developed in most of the early universities. The beginnings of the college may be traced to the conditions which made it desirable for the younger members of a university to live together. They were all, technically, clerks, and were possessed of the legal privileges of the clergy, though by no means all of them intended to proceed to Holy Orders. In addition to the ordinary difficulties and temptations which beset youths in a mediæval town, they had to meet the hostility of the townsmen, and were quite ready to join in the quarrel between town and gown. In Italy, where the presence of a university was important for the trade of a small city-state, this hostility was kept in check, and the students, through their universitas, presided over by a student-rector, were quite capable of taking care of themselves. They were mostly foreigners, and they were divided into nations, according to the place of their birth, and the nations afforded additional protection to their members. In Paris and in England the hostility of town and gown was much stronger, and the students were not the rulers of the university, nor did their organization into nations possess the same significance when the large majority of them were of one and the same nationality. Students at Oxford formed themselves into small clubs or societies for the sake of protection, economy, and social intercourse. Each of these houses or halls elected its own head and replaced him as the members chose. They made rules to govern their own societies, and the university did not at first interfere, though it afterwards insisted that every head of a hall should be a master of arts.

The development of the unofficial hall into the corporate college came about through the generosity of the pious donor, who endowed a hall and, along with his endowments, gave statutes and regulations, and obtained legal sanction for the foundation of a corporation. The student whose hall passed into a college remained under the authority of the university, which determined the length of the necessary residence and the subjects of study and examination, and conferred degrees; but he no longer shared with his fellows the regulation of their daily domestic life. Undergraduate members of a college were under the discipline of the head and the fellows, who were associated with the head in its government, and the rules administered by the governing body were prescribed in the statutes made by the founder. No conversation was permitted in English, all kinds of games and amusements were forbidden, and other regulations prohibited the carrying of arms, unpunctuality, talking or reading during meals (instead of listening to a passage from the Bible, which was read aloud), bringing strangers into college, absence without permission, and similar offences. As time went on, college discipline became more strict, and the ordinary punishments, which at first had taken the form of the withdrawal of allowances for food, came to include the infliction of a flogging, even at the age of eighteen or twenty. The provision made by founders for their students also became more elaborate; the first college buildings were, with one or two exceptions, merely dwelling-houses bought for the purpose, but later founders erected magnificent buildings and gave more splendid endowments. The college came to be more than a mere living-place; it also provided instruction for its members, and college teaching largely superseded the teaching given by the university. As time went on, the influence of the college system led the university to prescribe a strict code of regulations for students who were not members of a college but still lived in independent halls.

The pre-eminence among universities in point of date belongs to Bologna, the 800th anniversary of which was celebrated in 1888. It is the archetype of the student-universities. The archetype of the master-universities was Paris. It developed from the cathedral-school of the city, and throughout its history the chancellor of the church of Notre-Dame had considerable authority. The date of its foundation cannot be definitely fixed, but it may be assigned to the second half of the twelfth century. The third great university in point of date is Oxford. Its origin is also largely conjectural, and a legend which traced its foundation to King Alfred was not entirely abandoned until the nineteenth century. It probably originated in a migration of English scholars from France after 1167, in obedience to an edict issued by Henry II during his quarrel with Becket. The college system, characteristic of Oxford to the present day, is also found at an earlier date in Paris than in England. The oldest Oxford college is Balliol, established before 1266, for although University College has a traditional and technical precedence, it does not seem to have come into actual existence before 1280. The first founder to erect a special building for the purpose of a college was Walter de Merton, whose foundation may be traced back as far as 1263, though not in complete form. The statutes of Merton College became the model for the foundation of subsequent colleges—Exeter (1314–6), Oriel (1324), and the Queen's (1341). In 1379 William of Wykeham founded New College on an unprecedented scale of magnificence, and his statutes superseded Walter de Merton's as the general model. The other pre-Reformation colleges were Lincoln (1429), All Souls (1438), Magdalen (1445), Brasenose (1509), Corpus Christi (1516), and Christ Church, begun by Wolsey as Cardinal College and ultimately founded by Henry VIII in 1532. All these were colleges for the secular clergy, and their members sacrificed their positions by joining any of the monastic or religious orders; but up to the Reformation several monasteries maintained separate colleges at Oxford for the instruction of their own members, and some of these were subsequently refounded as ordinary colleges. The impulse towards college-founding persisted until the first quarter of the seventeenth century; Trinity was founded in 1554, St. John's in 1555, Jesus in 1571, Wadham in 1613, and Pembroke in 1624. Only one college is of eighteenth-century foundation—Worcester (1714)—and two belong to the nineteenth—Keble (1869), and Hertford (1874), a restoration of an older institution. Only one of the ancient public halls survives—St. Edmund Hall, which traces its history as far back as 1269. Up to the last quarter of the fifteenth century the large majority of Oxford students were members of halls, for the residents in colleges were strictly limited to the small numbers actually on the foundation and supported by the endowments; but about that date the colleges began to take additional members, who paid for their board, lodging, and instruction, and the number of halls consequently decreased. Until comparatively recent years every member of the university had to be a member of a college or of a public hall, but the increase of numbers in the nineteenth century led first to the granting of permission to masters of arts to keep private halls, and in 1868 to the recognition of a body of non-collegiate students, supervised by a delegacy appointed by the university.

The history of Cambridge is similar to that of Oxford. Its origin has also been ascribed by legend to a very early date, but it probably owed its existence to a migration from Oxford in 1209. The college system was introduced in Cambridge about the same time as in Oxford. The earliest college, Peterhouse (1284), was followed by Clare (1326), Pembroke (1347), Gonville (1348, refounded by Dr. Caius in 1558), Trinity Hall (1350), Corpus Christi (1352), King's (1441—the most magnificent of mediæval foundations), Queens' (1448), St. Catharine's (1473), Jesus (1496), Christ's (1505), St. John's (1511), Magdalene (1542), Trinity (1546), Emmanuel (1584), Sidney-Sussex (1596), and Downing (1800). Non-collegiate students have been admitted to Cambridge since 1869.

England possessed only its two ancient universities until the nineteenth century. The University of Durham, founded in 1832, and the University of London, founded in 1836 and reconstituted in 1900, were the pioneers of the newer English universities, many of which developed out of university colleges, which originally had no power of granting degrees. There are now six universities of comparatively recent date—Manchester and Liverpool, each of which, in its present form, dates from 1903, though representing older institutions, Birmingham (1900), Leeds (1904), Sheffield (1905), and Bristol (1909). An East Midland university is in process of formation at Nottingham, and there are university colleges at Exeter, Reading, Southampton, and Newcastle, the last mentioned being part of the University of Durham. At none of the later English universities, except

Durham, was the college system introduced as a feature of the original foundation, but halls of residence exist in most of them. The University of Wales was founded in 1893 by the incorporation of three chief constituent colleges—Aberystwyth (1872), Cardiff (1883), and Bangor (1884).

Scotland possesses three pre-Reformation universities—St. Andrews (1411), Glasgow (1451), and Aberdeen (1495). In constitution the Scottish universities resembled the student-universities, inasmuch as their officers included an elected rector, but the head of the university was the chancellor, as in the master-universities, and the students were always under the government of the masters. The college system was introduced at St. Andrews, where lack of endowments checked its development, though three colleges were founded, and at Aberdeen, where only one college was founded, and it naturally became synonymous with the university. At Glasgow no college was founded, but a pedagogy or boarding-house established by the Faculty of Arts became the principal feature of the university, and was ultimately identified with it. This development led to the emergence of a characteristically Scottish office, the principalship, the principal regent of the pedagogy becoming principal of Glasgow, and the principal of King's College becoming the efficient head of the University of Aberdeen. Two universities were founded after the Reformation, Edinburgh in 1584, and Marischal College, Aberdeen, in 1593, the latter preserving a separate existence until its amalgamation with the university and King's College in 1860. Collegiate residence was never introduced at Edinburgh, and it had died out elsewhere in Scotland by the beginning of the nineteenth century. A new constitution was devised for the Scottish universities in 1858, and was remodelled in 1889.

In Ireland the University of Dublin (Trinity College), founded in 1591, was the only University until the nineteenth century, when institutions were established which have developed into the National University in the Free State, with colleges at Dublin, Cork, and Galway, and the Queen's University of Belfast in Northern Ireland.

Up to recent years women students were excluded from all the British universities. They were admitted to the Scottish universities in 1892, and since that date have been received as full members by all the universities except Cambridge.

The Italian universities of the Middle Ages were numerous, and included, besides Bologna, Salerno (a medical school older than Bologna), Padua, Siena, Naples, Rome, Perugia, Pisa, Florence, Pavia, and Turin. In France the universities next in antiquity to Paris were Orléans, Angers, and Toulouse, all founded in the first half of the thirteenth century. Four universities (including Avignon and Grenoble) date from the fourteenth century, and Aix, Poitiers, Bordeaux, Nantes, and four others belong to the fifteenth century. Some Protestant French universities were established after the Reformation. The University of Paris exerted a profound influence in the history of Europe up to the Reformation, and in the history of France up to the great French Revolution, when all French universities and colleges were dissolved by a decree of the Convention. In the nineteenth century academic education was controlled by the Université de France, really a State department, but in recent years some of the universities (including Paris) have been revived. There were some important mediæval universities in Spain and Portugal, including Salamanca (founded before 1230), Lisbon (1290), Barcelona (1450), and Valencia (1500). Germany was late in establishing universities. The first was Prague (1348), followed by Vienna (1365), Erfurt (1379), Heidelberg (1385), and Cologne (1388). Eleven foundations were made in Germany and the Low Countries in the fifteenth century, including Leipzig (1409), Louvain (1425), Mainz (1476), and Tübingen (1477), to which may be added Wittenberg (1502). In Northern Europe the most important universities were Cracow in Poland (1364), Uppsala in Sweden (1477), and Copenhagen (1477).

After the Reformation the most important new foundations were in Holland, which, after the vindication of its independence, rapidly acquired a great reputation for learning, and the Universities of Leyden (1575), Groningen (1614), and Utrecht (1634) were among the most famous in seventeenth-century Europe. In the more modern movement for the establishment of universities Germany took the foremost place. The German Reformation had already produced the Universities of Marburg (1527), Königsberg (1544), and Jena (1558), and from the end of the seventeenth century the German states started upon a new era of university-founding, illustrated by Halle (1693), Göttingen (1736), Erlangen (1743), Berlin (1810), and Bonn (1818). The foundation of Berlin University marks an important era in the history of the German universities, which, liberally endowed by the State, came in the course of the nineteenth century to enjoy a pre-eminent reputation.

The oldest universities in the United States are Harvard (1638) and Yale (1701); and some other colleges, including King's (now Columbia), New Jersey (now Princeton,) Pennsylvania, and William and Mary, existed in the colonial period. The nineteenth century witnessed a very large extension of the university system, and there are now about 670 institutions described as universities or colleges, but only a small proportion of these are of recognized university standing. There has been a similar development in the British overseas dominions. Canada possesses twenty-two universities, of which the most famous are Toronto, M'Gill (Montreal), Dalhousie (Halifax), and Laval (Quebec), and a large number of university colleges. In Australia there are universities at Melbourne, Sydney, Adelaide, and Perth, and there is also a University of New Zealand, with four constituent colleges. In South Africa the University of the Cape of Good Hope, established in 1873, has been succeeded by the University of South Africa, with colleges at Grahamstown, Wellington, Bloemfontein, Pretoria, Pietermaritzburg, and Potchefstroom; and there is also the University of Cape Town (a development of the South African College, founded in 1829), and the Universities of Stellenbosch and Witwatersrand. There are fourteen universities in India, including Calcutta, Madras, Bombay, and Allahabad.—BIBLIOGRAPHY: H. Rashdall, *The Universities of Europe in the Middle Ages*; R. S. Rait, *Life in the Mediæval University*; M. Arnold, *Schools and Universities on the Continent*; *Minerva* (a Year Book of the universities of the world).

University College, Oxford, the oldest in the university, founded about 1253, though the exact date of its foundation is doubtful. Its first statutes date from 1280.

University Extension, a movement for bringing university teaching within the reach of a wider public. The scheme originated at Cambridge in 1873, and was adopted by London in 1878 and by Oxford in 1885. Since then the movement has spread throughout Great Britain and Ireland. The organizations arrange for series of lectures to be given at local centres during winter, and for examinations to be held.

Unknown Warrior. The unveiling of the War Memorial Cenotaph at Whitehall by King George V on 11th Nov., 1920 (Armistice Day), was immediately followed by the burial of an Unknown Warrior in Westminster Abbey. The body of a British private soldier, name unknown, had been removed from its first resting-place upon the Western Front and carried to Boulogne, where, on the night of 9th Nov., it lay in state in an improvised *chapelle ardente* of the thirteenth-century château. The following day, after receiving the salute of France from Marshal Foch, it was placed on board the French battleship *Verdun* and escorted across the Channel by representative vessels of the British navy; thence to its tomb among the nation's most illustrious dead. A similar ceremony was performed by several other countries.

Unna, a town of Germany, in the Prussian province of Westphalia; an important railway junction on the Düsseldorf-Soest line for Hamm and Fröndenberg. It is an ancient place which secured the privileges of a town in 1256 and was a member of the Hanseatic League, and it is now a brisk industrial town with a large beer-brewery, brick-kilns, cement-works, large tramway-car works, iron-foundry, and machine-shops. Pop. 20,000.

Unst, the most northern of the Shetland Islands; length, 10 miles; average breadth, between 3 and 4 miles; pop. 1817.

Unterwalden, a Swiss canton, bounded on the north by the Vierwaldstätter See (Lake of Lucerne), on the east by mountains which separate it from Uri, on the south by Bern, and on the west by Lucerne; area, 295 sq. miles. It is divided into two valleys or half-cantons, Upper and Lower (Obwalden and Nidwalden), and these districts (politically distinct) each send a representative to the Swiss Council. The chief town of Obwald is Sarnen (pop. 4500), and of Nidwald, Stans (3000). Area: Obwalden, 183 sq. miles; pop. 17,570; Nidwalden, 112 sq. miles; pop. 13,960. Both cantons are almost entirely German-speaking Roman Catholic.

Unyoro, or **Bunyoro**, the most southerly district of the Northern Province of Uganda, bounded in the north by the Victoria Nile, south by the Nkussi River and the River Kafu, and lying east of Lake Albert, nearly the whole of Uganda's share of which is in Bunyoro. The district forms a native kingdom ruled by a *mukama*, who presides over a parliament or *lukiko* at Masindi. Another *lukiko* sits at Hoima. Physically, Bunyoro is a plateau (3000–3800 feet altitude) capped by conical hills (4000–4800 feet), which reach their highest point in Palajoki (4876 feet), north of Hoima. The plateau presents a steep escarpment, the eastern wall of the western rift valley, to Lake Albert, but the walls are not so high or so imposing as those on the western side of the lake. The mean annual temperature is about 78° F., and there are four distinct seasons: (1) December to February (dry; 2·5 inches rainfall); (2) March to May (wet; 12 inches rainfall); June to August (dry; 8 inches rainfall); (4) September to November (wet; 11 inches rainfall). Cattle-raising is important. In Bunyoro the land is the property of the tribal chiefs and the *mukama*. Native coffee-plantations are extensive; but millet, sweet potatoes, and tobacco are the chief crops. Bunyoro is the chief afforested region of Uganda, containing the Budongo and Bugoma forests. Plumbago (near Hoima), graphite, and gold have been found, and iron ore is worked. Masindi is the capital. It lies at the foot of Kigulya Hill (4500 feet), and, laid out in 1912, has developed rapidly, containing an hotel, prison, native hospital, European club, and golf-course. It is connected by road with Butiaba (altitude, 2028 feet, i.e. the same as Lake Albert), the best harbour on Lake Albert, and an outlet for passenger traffic from Uganda to the Belgian Congo, or down the Nile to Khartum. It is a hot, low-lying mosquito-trap. Kibero, 11 miles south of Butiaba, lies on an alluvial flat fringing the lake, and has salt-works and hot springs. Hoima (3665 feet), 18 miles from Kibero, was the Bunyoro head-quarters between 1900 and 1912. It is the centre of a millet-growing region, and is connected by road with Masindi (34 miles). Fajao (3764 feet) is on the Victoria Nile. Port Masindi stands at the head of Lake Kioga, where the Victoria Nile emerges, and is on the motor road to Masindi (29 miles). It is the terminal port of the lake-steamer service to Namasagali for the Busoga Railway to Jinja and Lake Victoria. The natives of the district call themselves *Banyoro* and their kingdom *Bunyoro*. The Banyoro are divided into two classes, Hamitic and Bantu, both speaking a Bantu language. The Hamites, the upper class, are tall and well formed nomadic pastoralists, and the Bantus, the lower class, are coarser and smaller-built sedentary agriculturists.

Upanishads, philosophical and religious discourses of the early Brahmans of India. *Upanishad* is derived from the root *sad*, ‘ to sit ’, with the prefixes *upa* and *ni*, and seems to have originally meant *séance*, attendance (of a disciple before a master), thence mystic doctrine. The oldest Upanishads were Sanskrit prose discourses belonging to the Āraṇyakas or ‘ Forest Books ’ appended to the Brāhmaṇas (see below, under *Vedas*): thus the Aitarēya and Kaushītaki Upanishads belong to the Ṛigvedic schools so named, the Chhāndōgya and Kēna to the Tāṇḍins and Talavakāras of the Sāma-vēda respectively, the Taittirīya to the Taittirīyas of the Black Yajur-vēda, and the Bṛihad-āraṇyaka to the Vājasanēyins of the White Yajur-vēda. All these are probably not later than 500 B.C. Then came a number of similar tracts in verse, chief being the Katha or Kāthaka (of the Kāṭhakas, Black Yajur-vēda), Īśāvāsya (of the Vājasanēyins, White Yajur-vēda), Śvētāśvatara (Black Yajur-vēda), and Muṇḍaka (Atharva-vēda), which were followed by many others, mostly sectarian, including many of doubtful canonicity and some quite modern concoctions. The number usually admitted in modern editions is 108.

Certain schools of Vedic philosophy had tended towards pantheism, conceiving the whole universe as being fundamentally a unity or single world-spirit; the Upanishads, progressing towards monistic idealism, identified this spirit, which they called *Brahma* (neuter), with the self-consciousness (*ātman*, ‘ self ’) of the individual thinker. This idea they expressed in formulæ like *aham brahmāsmi*, ‘ I am Brahma ’; *tat tvam asi*, ‘ thou art It ’. The intuitive recognition of this identity by the sage, they maintained, was the salvation of the soul, which thereby won release from the cycle of transmigration (the Upanishads, it should be observed, are the first Indian texts to enunciate distinctly the doctrine of transmigration). Much of the earlier Upanishadic literature is obscure by reason of the authors’ difficulty in finding philosophic expression for their ideas; often, especially in the older parts of the Chhāndōgya, Taittirīya, and Bṛihad-āraṇyaka, which are notably composite, they use symbols and metaphors derived from the phenomena of nature and the crude Vedic ritualism. Gradually, however, they threw off these fetters, and succeeded in uttering their thoughts in language of remarkable vigour and eloquence, though unsystematically and sometimes inconsequently. The Upanishads above mentioned, together with a few others, came to be regarded as the scriptural authority for the highest religious-philosophic thought of India, and in order to harmonize them into a consistent system of idealism the Brahma-sūtra, a series of aphorisms wrongly ascribed to Bādarāyaṇa, was composed, perhaps between A.D. 200 and 500. On these bases were founded most diverse systems, such as the absolute monism of Śaṅkara, the semi-monistic theisms of Rāmānuja, Nimbārka, and others, and the dualistic theism of Madhva.

Upas, a tree common in the forests of Java and of some of the neighbouring islands, and found also in tropical Africa. It is a species of the genus Antiaris (*A. toxicaria*), nat. ord. Moraceæ. Many exaggerated stories were formerly current concerning the deadly properties of this plant. The truth is, that the upas is a tree which yields a poisonous secretion and nothing more.

Upington, a town of Cape Province, South Africa, the metropolis of an agricultural district. Pop. 3000. See *South-West Africa* (section *Railways*).

Upper-Senegal-Niger, or **French Sudan**, a colony of French West Africa, comprising the former Senegambia and Niger territories, which in 1904 were amalgamated with the military territory of Timbuktu to form one colony; area, 617,600 sq. miles; pop. 2,500,000. The colony is entirely inland, and is traversed by the Senegal and the Niger Rivers. Native food-grains, ground-nuts, cotton, and sesame are the chief agricultural products; cattle-raising is progressive; and there are many native manufactures (leather, pottery, &c.). Rubber and gum are important items of export. The Thiés-Kayes Railway (see *Senegal*) enters the territory to the south-west of Ambidédi and runs to Kayes, whence there is an extension up the Senegal Valley, via Bafoulabé and Kita, to the Niger at Bamako (the capital; pop. 16,000), thence up the right bank to Koulikoro (some 390 miles from Ambidédi). French Sudan has been the official name of the colony since Dec., 1920.

Upper Silesia. See *Silesia.*

Upper Volta, a colony of French West Africa, comprising a southern section of French Sudan, from which it was detached in March, 1919; area, 154,500 sq. miles; pop. 2,980,000. The colony is entirely inland, lying within the great bend of the Niger, and its production is similar to that of French Sudan. Bouaké, the northern terminus of the Ivory Coast Railway, is connected by motor-car with Ouagadougou (pop. 19,400), the Upper Volta capital.

Uppingham, a town of Rutland, England. It is an agricultural centre, but is especially noted for its grammar-school, which was founded in 1584 by Archdeacon Johnson, and became one of the most important of English public schools under the headmastership (1853–77) of Edward Thring. Pop. 6250.

Uppsala, or **Upsala,** a maritime län (government) of Sweden, between the län of Västmanland and Stockholm, and with a seaboard on the Gulf of Bothnia. Agriculture flourishes in the plain, but in the north mining (chiefly iron at Dannemora) is the principal industry. The län is served by the railway from Stockholm to Storlien (464½ miles), via Storvik (for Gefle (q.v.) and Falun). Uppsala, the capital, is on this line, and is connected also with Norrtelje, Enköping, and Gefle direct. Enköping (pop. 5000) is the second town of importance. It is a junction on the Stockholm-Frovi line for Uppsala town, manufactures watches, and has market-gardening interests. Area of län, 2051 sq. miles; pop. 138,500.

Uppsala (ancient **Östra-Aros**), the chief town of the län of Uppsala; served by rail to Gefle (71 miles). It contains the chief Swedish university, founded in 1477; a cathedral originally built between 1260 and 1435, and containing the tombs of Swedish monarchs; and an observatory. Uppsala has been an archiepiscopal see since 1276, when the archbishop removed from Gamla Uppsala, the old capital of the pagan kings of Sweden and the site of the *Kungshogar*, or Tumuli of the Kings, three huge burial-mounds named after the old Scandinavian deities, Odin, Thor, and Freya. The university library contains more than 250,000 volumes and about 7000 MSS., including the *Codex Argenteus*, a Mœso-Gothic translation of the Gospels by Bishop Ulfilas (fourth century), captured at Prague in 1648, and the main source of knowledge of the ancient Gothic language, the progenitor of modern Teutonic tongues. Both cathedral and university suffered greatly in the fire of 1702, as did also the old castle, now partly in ruins, but founded in 1548 by Gustavus Vasa. Pop. 29,100.

Uræmia is a condition due to the toxic state of the blood, and arises most probably as a result of the accumulation of substances which are normally excreted by the kidneys. The condition, which usually follows on some form of kidney disease, is an extremely serious one and often fatal. Its outstanding symptoms are headache, laboured and noisy breathing, gastro-intestinal disturbances, convulsions, paralysis, delirium, and coma.

Ural, a river of Russia, which rises in the Ural Mountains, forms part of the boundary between Europe and Asia, and enters the Caspian after a course of over 1000 miles.

Ural-Altaic (also called *Turanian*, *Finno-Tataric*, and *Scythian*), a family of languages spoken by peoples inhabiting the 'Turanian region' covered by the map given under *Turanian.* The name is a purely artificial compound indicating the two main topographical features and natural boundary-marks of the country in which originated the proto-historic language from which the tongues of the Ural-Altaic system are said to have been derived. Much debatable ground remains to be explored, especially in regard to the genealogical connections of the various units; but the chief divisions and subdivisions of the family may be outlined as follows:

1. **Ugro-Finnic.** *Finnic subgroup.*—Finnish (or Suomi), spoken in Finland (see *Finns*); Tchudic (including Vepsic and Votic; see *Tchudes*); Karelian, spoken from the White Sea to Lake Ladoga; Livonian and Crevinian; Estonian (see *Esthonia*); Lapponic (of Lapland, q.v.). See *Ugro-Finns.*

Permian subgroup.—Permian, Sirienian, Votyak (q.v.), all three spoken around the Urals.

Volga-Finnic subgroup.—Mordvinian (of the Middle Volga), Tcheremissian (of the region between Kazan and Nijni-Novgorod).

Ugric subgroup.—Vogul (see *Voguls*), Ostyak, and Magyar (see *Hungary*). See *Ugrians.*

2. **Samoyedic.** See *Samoyeds.*

3. **Tungus,** spoken by the Manchus of Manchuria and the Tungus (q.v.).

4. **Mongolian.**—Mongolian (or Sharra), spoken westward of the Manchu group in the north of the Chinese Empire; Buriat, spoken about Lake Baikal in the Far Eastern Republic; and Kalmuck (Western Mongolian), which extends westwards to the Caspian and to European Russian between the Don and the Lower Volga. See *Kalmucks.*

5. **Turko-Tataric** (Turkic or Tataric). — The group extends from Thrace to the Lena (East Siberia), and includes Yakut (q.v.); Kirghiz (q.v.); Nogair (spoken by the Russian Cossacks in the Crimea and south of the embouchure of the Volga towards the Sea of Azov); Niguric (including Nigur, Jagataic, and Turkman; see *Turcoman*), the dialectic tongues of Turkestan apart from the Kirghiz regions; and Turkish, the tongue of the Osmanlis generally, although the official Turkish language has many exotic elements, mainly Persian and Arabic.

See articles *Pan-Turanianism*; *Turkey* (*Ethnology*); *Tatars*; *Buriats*; *Philology* (section *Agglutinative Languages*).—Cf. T. G. Tucker, *Introduction to the Natural History of Language.*

Uralite, pseudomorph of amphibole after pyroxene, occurring in igneous rocks. Also a kind of artificial fire-proof material manufactured from asbestos.

Ural Mountains, a series of mountains and plateaux stretching nearly north and south between Europe and Asia, from the shores of the Arctic Ocean, for a distance of about 1900 miles; highest summit, 5518 feet. There is but little striking scenery, and the rise is so gradual in some parts that the traveller from Perm to Ekaterinburg, for instance, hardly notices that he has crossed the chain. The Ural Mountains are specially known for the gold, platinum, copper, coal, and iron which they contain.

Uralsk, a former government of Russian Central Asia, now a government of the Kirghiz Autonomous Republic. It is mainly a flat sandy plain, marshy in places, and rising in the north to a hilly steppe. The Ural, Sagis, and Emba are the chief rivers. Agriculture is confined to the north, and the main business is cattle-raising. Uralsk is the capital. Area, 81,711 sq. miles; pop. (1923), 630,000 (largely Muslim-Kirghiz).

Uralsk, a town of the Kirghiz Republic, Central Asia, capital of the government of Uralsk, at the confluence of the Tchegan and Ural; served by rail from Saratov (q.v.). It is an up-to-date place with churches, mosques, library, museum, high school, theatre, musical academy, and several newspapers. A brisk trade is carried on in cattle and fish. Pop. 38,000.

Uranium, a metallic element, the atomic weight (238·2) and atomic number (92) of which are the highest known. The chief source of the element is the mineral uraninite, or pitchblende (q.v.). Chemically it is related to chromium, molybdenum, and tungsten. It forms two series of salts, uranous and uranyl. Sodium uranate, or uranium yellow, is used as a pigment for painting on glass and porcelain. The chief interest of uranium, however, lies in its radioactive properties (see *Radio-activity*). In its minerals, it is always associated with radium, the proportion in an old mineral being 330 milligrams of radium to 1000 kilograms of uranium. The low-grade ore *carnotite*, which occurs abundantly in Colorado, is now worked on a large scale for radium.

U'ranus, in Greek mythology, the son of Gæa, the earth, and by her the father of the Titans, Cyclopes, and Hecatoncheires. He hated his children, and confined them in Tartarus, but on the instigation of Gæa, Kronos, the youngest of the Titans, overthrew and dethroned him.

Uranus, in astronomy, one of the major planets, and the seventh from the sun, discovered by Sir William Herschel in 1781. It was first called *Georgium Sidus*, in honour of George III, and afterwards *Herschel*, in honour of the discoverer. To the naked eye it appears like a star of the sixth magnitude. Its mean distance from the sun is about 1782 millions of miles, and the length of the year 30,688 days, or about 84 of our years. Its mean diameter is estimated at over 30,000 miles. Its volume exceeds the earth's about 60 times, but as its mean density is only about one-fourth of the earth's, its mass is only about 14·6 times greater. From the shift of lines in the spectrum, a rotation period of 10¾ hours has been deduced. Uranus has four satellites, revolving in a plane which is only 8° from being perpendicular to the ecliptic. Their motions projected on the ecliptic are retrograde, or east to west.

Urban, the name of eight Popes, of whom the most notable were: **Urban II**, 1088–99; it was at his instigation that the first Crusade was undertaken, and Jerusalem captured.—**Urban VI**, 1378–89, so exasperated the cardinals by his reforming zeal that they caused a schism in the Church by electing Clement VII. The two Popes excommunicated each other until Urban died, under circumstances which suggested poisoning. —**Urban VIII** (Maffeo Barberini), 1623–44, was more of a temporal prince than a cleric, and was the Pope who condemned Galileo and Jansen.—Cf. L. Pastor, *History of the Popes*.

Urbana, a city of Ohio, United States, the county seat of Champaign county; served by the Erie and other railways. It is the seat of Urbana University, and is a farming centre, with manufactures of telephones, paper, and machine-shop products. Founded in 1805, it became a city in 1867. Pop. 11,000.

There is another Urbana in Illinois, the seat of Illinois State University. Pop. 10,000.

Urbi'no (ancient **Urbinum**), a city of North Italy, in the province of Pesaro e Urbino. It is the see of an archbishop, and seat of a small university (founded 1671); the chief buildings are the ducal palace and the cathedral (1801). It was the birth-place of Raphael, whose house is still shown. Pop. 18,117.

Urea, or **Carbamide**, $CO(NH_2)_2$, a soluble crystalline substance occurring in urine. It may be regarded as the final product of the oxidation of nitrogenous compounds in the body. Urea was the first animal product to be prepared synthetically.

Uredineæ, a large, important, and very numerous family of Fungi, comprising about 20 genera and 1500 species, commonly known as rusts. They are all parasites on higher plants, and many cause most destructive diseases on cultivated plants, especially the species of Puccinia that attack cereals and the coffee-rust (Hemileia). See articles on these and on *Melampsora* and *Uromyces*.

Urfa, a town of Turkey, in Asia Minor. There are several cotton manufactories, and trade is carried on in wheat, wool, hides and skins, and cotton. Pop. 55,000.

Urfa is the modern embodiment of the ancient city of *Edessa*, which, built by Seleucus Nicator, fell into the hands of the Saracens in A.D. 1184. In Christian times *Edessa* was the principal seat of Oriental learning, and was famous for its schools of theology, the chief of which was the *Scholia Persica*, carried on especially for the instruction of Christian Persians, who were at that time great students of Syriac. Under John, Patriarch of Antioch, and Ibas, Bishop of Edessa, the professors took a leading part in the Nestorian controversy, and their Nestorian teachings led to the ultimate downfall of the school, which was demolished in 489 by Zeno, the Roman Emperor, the professors having already been expelled by Martyrus, Bishop of Edessa. Edessa has been mistaken for Ur of the Chaldees (q.v.), but, as the name probably does not go back farther than 150 B.C., this contention is inadmissible, although it is believed by Mahommedans, whose chief mosque is called the Mosque of Abraham.

Urga, the capital of Outer Mongolia. Pop. 30,000. See *Mongolia.*

Uri, a canton of Switzerland, bounded by Schwyz, Unterwalden, Valais, Tessin, Grisons, and Glarus; area, 415 sq. miles. The chief industries are stock-raising and dairying. The inhabitants are mostly German-speaking Roman Catholics. Uri was one of the three original Swiss cantons. The capital is Altorf (Altdorf). Pop. (1920), 23,973.

Uri comprises the valley of the Reuss, which passes into the Plain of Altdorf lying on the Urner See, the eastern arm of the Lake of Lucerne. The Reuss Valley is traversed by the famous St. Gothard Railway, opened in 1887 and forming part of the trunk line from Lucerne to Bellinzona, Lake Maggiore, Lugano, Chiasso, and Rome. From Lucerne it runs by way of the north shore of the Lake of Lucerne, via Küssnacht (pop. 4000), Goldau (for Zürich; 2000), and Flüelen (1000; the port of Altdorf), to Altdorf (34 miles from Lucerne); then up the Reuss Valley, via Erstfeld, Amsteg, Gurtnellen, and Wassen, to Göschenen (1000; for the St. Gothard Tunnel, 9¼ miles long). Flüelen and Altdorf are connected by electric tramway, and Altdorf stands at the junction of the Reuss Valley with that of Schächen, along which a line runs, via the Klausen Pass (6400 feet altitude), to Linthal (31 miles).

Uric Acid is found normally in the urine of mammals in small quantities, and is the means by which a small quantity of nitrogen is excreted from the body. In birds and reptiles, however, it is found in much larger quantities. When pure it crystallizes in colourless rectangular plates or prisms, but in human urine, when precipitated, it takes on many varied shapes and forms. In excess it tends to form concretions (calculi) found in the kidneys and bladder. See *Calculus.*

Urim and Thummim, the sacred lots by which the Israelites ascertained the Divine will. The explanation that the words mean *light* and *perfection* is generally rejected. The lots were two in number, and it was therefore agreed beforehand as to the manner of interpreting the issuing lot. To handle the *urim* and *thummim* was a prerogative of the priests, and in *Exod.* xxviii, 30, they are described as part of the high-priest's costume. The *urim* and *thummim* have been identified with the jewels of the high-priest's breastplate, and it has been conjectured that they were two stones of different colour. The rabbis supposed that these stones indicated the Divine will by a preternatural luminosity.

Urine is the fluid excreted by the kidneys, passing from them down the ureters to the bladder, where it accumulates, to be discharged from the body through the urethra. The urine, which has a characteristic odour, is normally acid in reaction, but it becomes less acid and may even become alkaline during digestion. The specific gravity in health is between 1010 and 1025, varying inversely with the quantity, while in certain pathological conditions it goes below, and in other conditions above, these limits. Normally about 50 oz. are passed in twenty-four hours, and of that amount 1¼ oz. are solids, the chief constituents of normal urine being water, urea, and sodium chloride.

Urocystis, a genus of parasitic Fungi, family Ustilagineæ. *U. occulta* destroys shoots of rye, and *U. Cepulæ* attacks and often kills seedling onions.

Urode'la, an order of amphibian vertebrates in which the larval tail is always retained in the adult, the body being elongated posteriorly into the tail. There are two sections, the *Perennibranchiate Urodela,* in which the gills are retained through life, as in proteus, siren, &c.; and the *Caducibranchiate,* in which the gills disappear at maturity, as in newts and salamanders.

Ur of the Chaldees, a Sumerian city, the city of Abram, which he and his family left to proceed to the land of Canaan. It is mentioned in *Gen.* xi, 28, 31; xv, 7; and *Neh.* ix, 7, but no clue to its position is given. Stephen, however, places it in Mesopotamia (*Acts,* vii, 2–4), and his statement, or the implication contained in that part of his speech, has given rise to a great amount of controversy among theologians and geographers, some of whom have mistaken the place for Urfa (q.v.). The most commonly accepted theory at the present time assigns the locality to the real Chaldæa, the low country near the Persian Gulf, and specifically to modern Mugheir or Mukayyar, a place near the Euphrates opposite its junction with the Shatt-el-Haï (from the Tigris). This place represents the Babylonian *Uru,* and satisfies, besides, all the requirements of the Biblical Ur. Warka is no longer considered as Ur, but is identified with Erech of *Gen.* x, 10.

Uromyces, a genus of parasitic Fungi, family Uredineæ, distinguished from Puccinia by the one-celled winter-spores (teleutospores). The most important species are *U. Betæ,* beet-rust; *U. appendiculatus,* scarlet-runner rust; *U. Fabæ,* broad-bean rust; and *U. Pisi,* pea- and vetch-rust; the last-named is heterœcious (see *Puccinia*), the cluster-cup stage growing on species of spurge (Euphorbia).

Ur′sula, St., a virgin martyr, according to the legend, a daughter of a prince in Britain put to death at Cologne by a horde of Huns, some say in A.D. 384, others in 453, together with 11,000 virgins who accompanied her. According to an earlier and more probable reading, the number of her companions was only eleven.

Ur′sulines, or **Nuns of St. Ursula**, a sisterhood founded by St. Angela Merici, at Brescia, in 1537. The Canadian Ursulines date from 1639; the Irish from 1771. The Ursulines have several educational establishments in Ireland, England, and Scotland.

Urtica′ceæ, a natural order of dicotyledonous (apetalous) trees, herbs, and shrubs. In an extended sense the order includes the Ulmeæ, or elm family; the Moraceæ, or mulberry family; and the Cannabineæ, or hemp family. But the order is more frequently confined to the Urticeæ, or nettle family; typical genus, Urtica (see *Nettle*). The juice of the restricted order is watery, not milky; the wood in the arboreous or shrubby species, which are all tropical, is soft and light. The fibre of the bark of some is valuable.

U′rubu, the native name of an American vulture, the *Catharista atratus* (black vulture or zopilote), very nearly allied to the turkey-buzzard. This voracious bird is common in the Southern States of North America, acting as a scavenger.

Uruguay, the smallest republic of South America, known officially as the *República Oriental del Uruguay*. It is divided into nineteen departments as follows:

Departments.	Area,[1] sq. Miles.	Population (approx.).
Artigas	4,394	40,000
Canelones	1,834	122,000
Cerro-Largo	5,763	60,650
Colonia	2,193	90,200
Durazno	5,525	58,550
Flores	1,744	24,870
Florida	4,673	65,660
Maldonado	1,587	43,000
Minas	4,819	71,850
Montevideo	256	393,170
Paysandú	5,115	76,000
Rio Negro	3,269	39,000
Rivera	3,793	48,300
Rocha	4,280	50,000
Salto	4,865	80,650
San José	2,688	64,000
Soriano	3,561	59,300
Tacuarembó ..	8,112	70,000
Treinta y Tres ..	3,682	43,400
Total	**72,153**	**1,500,600**

[1] Area according to *The Statesman's Year Book*.

Montevideo is the republican capital; other towns are Paysandú, Minas, Maldonado, Rivera, Rocha, and Fray Bentos, articles on which should be referred to. Other departmental capitals (besides those mentioned) are: San Eugenio, capital of Artigas, Uruguay's most northern department; Canelones, or Guadeloupe, capital of Canelones, the chief Uruguayan stock-raising department; Melo, capital of Cerro-Largo; Colonia, seaport-capital of Colonia; Durazno, or San Pedro del Durazno, capital of Durazno; Trinidad, capital of Flores; and Florida, capital of Florida. Mercedes is the chief port on the Rio Negro.

Physical.—Uruguay comprises two distinct regions, plain and plateau. The latter forms the southern projection of the Brazilian Highlands, and is divided roughly into an eastern division, the Cuchilla Grande, and the more northerly Cuchilla del Haedo, both being under 1500 feet altitude. On the eastern frontier (to the Brazilian department of Rio-Grande-do-Sul) is the Lago Mirim, to which the eastern versant of the Cuchilla Grande is drained, mainly by rivers of the Cebollati system. The hydrographic system of Uruguay is simple, for, excepting only the small area of coastal drainage, the rest of the republic belongs to the drainage basin of the Uruguay River, which forms the whole of the western frontier (about 235 miles). Nearly the whole of the waters of the central region of Uruguay are carried to this stream of the Rio Negro with the Yi and other affluents, whose drainage basin is thus equal to one-half (approximately) of the total area of the republic. In addition to the Uruguay river-frontage, there is a seaboard of 120 miles on the Atlantic and of 235 miles on the La Plata estuary. Rainfall is about 43 inches per annum, well distributed over the whole year; and the mean annual temperature is 62° F. (January, 73°; July, 51·8°). May is the rainiest month in Montevideo. Generally speaking, the climate is an exceptionally healthy one, and is reflected in the mentality and physique of the people.

Production.—The live-stock industry dwarfs all others in Uruguay, and the production of meat, hides, skins, and wool is highly specialized. With the meat trade such firms as Liebig's, Armour, and Swift are mainly concerned, and slaughter together between 300,000 and 600,000 cattle, and from 100,000 to 330,000 sheep per annum. About 60 per cent of the area is used for pastoral purposes, and over 90 per cent of the exports are connected directly with the meat-producing industry. The wool-clip is important. Only about 5 per cent of the area is devoted to agriculture, which is confined mainly to the departments of Canelones, Colonia, Florida, Minas, and San José. Wheat, corn, and oats are the chief crops. Wine is produced in Canelones, Colonia, Paysandú, and other departments. Miscellaneous industries include the brewing of beer, match-making, and manufactures of leather and leather goods, furniture, and household commodities in general. Uruguay's best customers are the United States, United Kingdom, Germany, France, Spain, Italy, Brazil, and Argentina, and with these countries the bulk of her trade is carried on. Imports are confined chiefly to manufactured goods, such as sugar, coffee, rice, olive-oil, kerosene, wood, alcohol, cotton stuffs for clothing, cotton yarns and thread, clothing of all kinds, agricultural machinery, and paper.

Communications.—The republican mercantile marine is insignificant, and maritime communications are maintained largely by foreign shipping. There are 1625 miles of railways, of which 139 miles are State-owned. The chief line is that operated by the Central Uruguay Railway, and known as the Combined System (980 miles), the trunk line of which serves the central departments and connects Montevideo with Rivera and Santa Anna do Livramento (Brazil). The Midland (320 miles) centres on Paysandú, and the North-Western (113 miles) on the river-port of Salto, which it connects with Uruguayana (Brazil) and with the Northern Railway (73 miles) at Isla Cabello. San Eugenio or Artigas is the terminus of the latter system, which serves a thinly peopled stock-raising region. Operated by the State are the lines Olmos-Maldonado (78 miles), Montevideo-Santiago Vasquez (12 miles), Durazno-Trinidad (29 miles), and Rocha-La Paloma (20 miles). The standard gauge is 4 feet 8½ inches. See *Rio-Grande-do-Sul*.

Social, &c.—The predominant religion is the Roman Catholic, but religious liberty is guaranteed, and Church and State are distinct. Primary education is compulsory, and there is a university at Montevideo, besides polytechnics throughout the republic, and a military college. There is a small voluntary standing army, which is supported by a conscripted National Guard divided into three 'bans' of varying age-limits. The total war strength of both corps amounts approximately to 150,000 men. A 'fleet' of four nondescript vessels is maintained. There is a theoretical gold standard, but only foreign gold is in circulation. Silver coins are the *peso* (dollar) of 100 *centisimos*, and the 50 *centisimos* and 20 *centisimos* pieces. Nickel coins worth 5, 2, and 1 *centisimos* are minted. Weights and measures are on the metric system.

Government.—Executive power is in the hands of a President and Administrative Council. The President is elected by popular vote for a term of four years, and may seek re-election eight years after the expiry of his term of office. The Council is elected by popular vote. Legislative power is vested in a bicameral Legislature comprising a Senate (appointed by an Electoral College of the people's own choosing, one Senator from each department sitting for six years) and a House or Chamber of Representatives (elected by popular vote for three years; one member to 120,000 adult males). A Cabinet, with portfolios of Foreign Affairs, War, Marine, and Interior, is appointed by the President; and to it the Council sends ministers of Education, Finance, Industry, and Public Works.

History.—The early history of Uruguay is that of Montevideo, which was founded by Spaniards in 1726, more as an outpost of Buenos Ayres than anything else, and ultimately (1778) became a free port. The expulsion of the Spaniards, in 1815, was followed by the occupation of the La Plata zone by Portuguese troops and the annexation of the region to Brazil (1824). In 1827, however, the imperialist régime was overthrown, and the independence of Uruguay was recognized by Argentina and Brazil on 25th Aug., 1828, mainly by the intervention of Great Britain. Montevideo suffered a nine-years' siege by Argentinian troops between 1843 and 1852. Anarchy reigned for many years, and revolution followed revolution with such rapidity that public welfare ceased to be attended to, and power was in the hands of the strongest, which by no means implies that it was also the monopoly of the fittest. After an appalling period of bloodshed and corruption Juan Cuestas became President, and laid the foundations of political stability. He was succeeded in 1907 by Claudio Williman, who further improved the government and the public services, and gave place in 1911 to José Battle y Ordónez, who completed the work of organizing the public departments, &c., and the suppression of revolutionary movements. Feliciano Vieira was the War President. He was elected in 1915 and was of pro-Allied sympathies. Uruguay declared war on Germany on 6th Oct., 1917. Vieira was succeeded in the presidency by Baltasar Brum.

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Uruguay, Rio, a river of South America, rising in Southern Brazil, and flowing southwards to form, with the Paraná, the Rio de la Plata (q.v.). It forms the territorial boundary between Argentina and Brazil, and between Argentina and Uruguay. See *Paysandú*.

Uruguayana, a city and river-port of Rio Grande do Sul, Brazil, on Uruguay River; served by rail to Montevideo, via Quarahim (frontier) and Paysandú (q.v.). Pop. 4000.

Urumchi, a town of Chinese Turkestan. It is a caravan and trading centre. Pop. 30,000.

Urundi and Ruanda, two provinces of former German East Africa. After the conquest of this colony, and at the end of the European War, it was assigned in its entirety to Britain as mandatory. The Imperial Government, however, handed over most of Ruanda and Urundi to the Belgian Congo.

Urus, a kind of large ox which ran wild in Gaul at the period of the Roman invasion, as described by Cæsar, perhaps the wild ox such as still exists at Chillingham in Northumberland and Hamilton in Lanarkshire, or else the aurochs.

Use, in law, the benefit or profit of lands and tenements that are in the possession of a person who simply holds them for another person, the real beneficiary. He to whose *use* or benefit the trust is intended, enjoys the profits, and is called *cestui que use* (= for whom is the use). All modern conveyances are directly or indirectly founded on the doctrine of *uses* and *trusts*, which has been deemed the most intricate part of the property law of England.

Usedom, a Prussian island in the Baltic, on the Pomeranian coast; area, 150 sq. miles. Agriculture and fishing are the chief industries. Swinemünde (the district capital) and Usedom are the chief towns, and both are served by a branch of the Stettin-Stralsund Railway from Ducherow.

The shores of Usedom are studded with villages, which are all linked up by coastal railway with Swinemünde, and which are largely frequented for sea-bathing. Among them are: Ahlbeck (pop. 4000), Heringsdorf (1000; pier; over 15,000 bathers come here yearly), Ückeritz, Koserow (700), and Zinnowitz (2000; about 10,000 bathers yearly).

Ushak, a town of Anatolia, in the vilayet of Brusa, on an affluent of the Menderes; served by the Central Railway to Konieh and Smyrna. Valonia and cereals are exported, but the town is best known by its carpets. Pop. 7000.

Ushant (u̧-shant′; Fr. *Ouessant*), an island of France, 15 miles off the west coast of the department of Finistère, to which it belongs; area, 6 sq. miles. Fishing and the rearing of sheep are the principal occupations. Pop. 2568.

Usher, or **Ussher**, James, Irish prelate, born at Dublin 1580, died 1656. He took orders in 1601; in 1607 received the professorship of divinity at Trinity College, Dublin, and the office of chancellor of St. Patrick's; in 1620 the bishopric of Meath; in 1623 a place in the Irish Privy Council; and in 1624 the primacy of all Ireland. He was a man of great erudition, his chief works being the *Annales Veteris et Novi Testamenti*, which forms the basis of the received Biblical chronology; and *Britannicarum Ecclesiarum Antiquitates*.

Usk, a river of South Wales and Monmouthshire, rising on Carmarthen Van, and flowing past Brecon, Abergavenny, Usk, Caerleon, and Newport to the Bristol Channel, which it joins 4 miles south of Newport after a course of 69 miles; drainage basin, 550 sq. miles. Between Newport and the embouchure the river is navigable, and in the higher reaches it is noted for salmon and trout.

Usk, a town of Monmouthshire, England, on the Usk. It is a place of ancient foundation, representing the Brythonic *Brynbega* and the Roman *Bullæum*. There is a grammar-school, and ruins of a castle founded by the Clares in the early thirteenth century, and said to be the birth-place of Edward IV and Richard III. The church of St. Mary represents a Benedictine nunnery also founded by the Clares. Pop. (1921), 1496.

Uskub, or **Skoplje** (the former being the Turkish and the latter the Slav form), a town of Yugoslavia, at the head of navigation on the Vardar; an important strategic rail and road centre, 150 miles from Salonika, on the Belgrade-Nish-Salonika Railway, which follows the ancient *Egmontian Way*, the north and south route between the Ægean and the Danube along the Morava and Vardar Valleys. A branch line runs to Mitrovitza (75 miles). Skoplje is an important trading and distributing centre whose commercial wealth is of recent growth. There is an opium market; and there are cotton-factories, tanneries, and dye-works. Leather, metal goods, grain, and plums are exported; antimony is found in the vicinity, and the town is also a centre of Yugoslavian cereal cropping (maize, barley, and oats) and sericulture.

Skoplje is the ancient *Scupi*, and represents *Justiniana Prima*, the city built by Justinian after the destruction of Scupi by earthquake (A.D. 518). The ruins of Scupi may still be seen. In the fourteenth century the town fell to the Osmanlis, from whom it was retaken by the Serbians in 1912, and lost to the Bulgarians in 1915 (European War), passing eventually to aggrandized Serbia.

Ussuri, or **Usuri**, a river of Eastern Asia, a right-bank tributary of the Amur, forming with the Sungacha (rising in Khanka (Hanka) Lake) the boundary between the Maritime Province of the Far Eastern Republic and the Chinese province of Manchuria. It is navigable for nearly the whole of its length (478 miles). The railway from Vladivostok to Khabarovsk follows the Ussuri Valley.

Ustilagineæ, or **Smuts**, an interesting group of parasitic Fungi, usually classed as a low type of Basidiomycetes, but possibly more nearly akin to the Chytridineæ. They attack various parts of the host, causing characteristic malformations, and ultimately filling the invaded organs with sooty masses of minute spores produced in prodigious quantities. The leading genera are Ustilago, the different species of which are the cause of smutted corn in cereal crops; Tilletia, one species of which (*T. tritici* or *T. caries*) produces the 'bunt' or 'stinking smut' of wheat; and Urocystis.

Ustron, a town and health-resort of South-Western Poland, on the Weichsel; served by rail to Bielsco (Bielitz). It has a bathing institute with mud-baths, an ironworks, and machine-shops. Pop. 6000.

Usury (Lat. *usus*, use), originally the payment of interest as consideration for the use of money; now the taking of iniquitous or illegal interest. By the Mosaic Law usury was forbidden among the Hebrews, though permitted between a Hebrew and a stranger; and the Canon Law, following the precept " Lend, hoping for nothing again ", prohibited it entirely. Gradually, however, many devices were adopted for overcoming the strict letter of the law, and by the sixteenth century the taking of interest had come to be generally recognized as fair and proper. From that period a series of statutes came into existence for the purpose of regulating the rates to be charged. For long the legal rate was 5 per cent, and no higher was enforceable; but in 1854 the usury laws were swept away and borrower and lender, generally speaking, left free to agree upon any rate of interest. Pawnbrokers' charges, however, are still strictly regulated by law, and the courts have power to review any transaction with a moneylender in which an excessive rate of interest has been charged. See *Moneylenders Act*; *Pawnbrokers*.

Utah, a state in the Mountain division of the United States. It is mountainous (general elevation, 5000 feet), and is divided into two regions by the afforested Wasatch Mountains, an extension of which, the Uinta Mountains (Gilbert Peak, 13,680 feet altitude), bounds the state in the north. The west belongs to the great basin, and is largely desert, a feature being the saline lakes (Great Salt, Sevier, &c.). Utah Lake is fresh. In the submontane zone conditions are more favourable. The east is a rugged mountain region which, with the south and part of the south-east of the state, is drained to streams of the Colorado river-system. The mean annual temperature at Salt Lake City (the capital) is 51·5° F. (January, 29·0°; July, 75·0°), and the rainfall 16 inches, March, April, and May being the rainiest months. Towns include Ogden (q.v.), Provo, and Logan. There are over 2600 miles of railway (about 500 being electric). Utah is largely agricultural, producing wheat and oats (the chief cereals,) maize, rye, barley, potatoes, and hay. Stock-raising is progressive, and wool is largely produced. Mineral products are important, and include argentiferous lead, zinc, copper, iron ore (hematite and magnetite), sulphur, petroleum, coal, salt, and precious and semi-precious stones. In religion the state is 75 per cent Mormon. Of the people, about 18 per cent are foreign-born, and of this number 26 per cent are English and over 12 per cent Irish. Only about 1 in 68,000 is coloured. Education is free and compulsory between the ages of six and sixteen years, and a measure of secondary instruction up to eighteen years is enforced. The University of Utah (Salt Lake City), agricultural college (Logan), Mormon University (Provo), and Mormon College (Logan) are the chief seats of higher education. Area, 84,990 sq. miles (2800 being water); pop. (1920), 449,396 (about 1560 being Indians, for whom there are 2389 sq. miles of reservations).

Settled by Mormons in 1847, Utah became a Territory in 1850 and a state of the Union in 1896. There is a bicameral Legislature, comprising Senate (20 members, elected for four years) and House of Representatives (55 members, elected for two years). Two Senators and two Representatives are sent to Congress.

Utah Lake, a freshwater lake of Utah, United States. It is 25 miles in length north to south, with an extreme width of 13 miles. Its waters are drained into Great Salt Lake by means of the River Jordan.

Ütersen, a town of Holstein, Prussia, on the navigable Pinnau; the terminus of a light railway to Tornesch. There are many industries, such as hat-making, tanning, brewing, and the manufacture of leathers, machinery, cloth, and cigars. A considerable shipping trade centres in Ütersen. Pop. 9000.

U′terus, or **Womb**, an organ of females, situated between the bladder and rectum, in which the embryo is contained until it arrives at maturity, when it is finally born or expelled. In the virgin female it is somewhat pear-shaped, and measures about 3 inches long, 2 inches broad, 1 inch thick, and weighs about 1½ oz. It is divided into a *fundus* or base, a *body*, and a *cervix* or neck. It opens into the vagina by a transverse aperture (*os uteri*). The organ is retained in its place by certain ligaments derived from the peritoneum. Its internal cavity is small, and at each superior angle at the fundus a *Fallopian* tube or oviduct enters. These tubes convey the ova or eggs from the *ovary* (q.v.) to the uterus. In structure the uterus is composed of an outer serous coat, a middle muscular coat, and an inner mucous lining. The arteries of the uterus are derived from the internal iliac and the aorta; the veins are large, and are called *sinuses* in the impregnated state. The nerves spring from the inferior hypogastric and spermatic plexuses, and from the third and fourth sacral nerves. The womb is liable to many diseases, of which the most frequent and important are inflammatory affections and tumours. It is also liable to become displaced in various ways, from laxity of its ligaments and other causes (see *Prolapsus Uteri*).

Utica, an ancient city of Tunisia, North Africa, of which only vestiges now remain. According to Aristotle, it was founded in 1100 B.C. (i.e. 287 years before Carthage) as a Tyrian

(Phœnician) colony, and stood at the embouchure of the *Bagradas* in the Bay of Carthage (Gulf of Tunis). It had artificial harbour-works and extensive fortifications; but the former have now been silted up and almost covered by deltaic deposits of the *Bagradas* (modern Majerda). Utica was the centre of a great corn-raising region with a large export trade (especially with Rome), and mineral-veins in the adjacent hills were extensively worked. Although the ally of Carthage from early times, Utica made a separate peace with Rome during the third Punic War, and received a grant of Carthaginian lands, becoming, later, the capital of the Roman province of Africa. It was the scene of the death of the younger Cato. Falling to the Vandals under Genseric (A.D. 439), it was recovered by the Byzantines, and later conquered by the Mahommedans, who eventually destroyed it. Valuable marbles and columns were transported to Tunis, and were embodied in the fabric of the great mosque there. See *Carthage* (map and article).

Utica, a city of New York, United States, the county seat of Oneida county, on the Mohawk River; served by the New York Central, Delaware, Lackawanna & Western, the West Shore, and other railways, and by the Erie Canal. It is an industrial city, and is the export centre for cheese and other dairy produce of a large agricultural region. Manufactures include hosiery, woollens and clothing, machinery, and metal goods. Utica was founded as Fort Schuyler, incorporated in 1797, and became a city in 1832. Pop. 94,200.

Utiel, a town of Spain, in the province of Valencia, on the Magro; the terminus of a railway (55 miles) from Valencia. Manufactures include wines, soaps, leathers, silks, and linen. Pop. 12,000.

Utilitarianism is a body of doctrine which was worked into a complete system of social philosophy by Jeremy Bentham (1748–1832). Its basis lay in the belief that every individual is governed in his actions by the desire to secure pleasure and to avoid pain. This 'hedonistic' standpoint was universalized by Bentham and made into a general ethical and social code, in accordance with which all political and social institutions should be judged by a single standard —the extent to which they contribute to or hinder the greatest happiness of the greatest number. At the same time it was assumed that this greatest happiness could in fact be assured by such a state of political and economic freedom as left each individual free to pursue his own happiness. Thus utilitarianism was in complete harmony with the general point of view expressed, independently of Bentham, by Adam Smith in his *Wealth of Nations*. This doctrine played a very important part in the first half of the nineteenth century, and influenced legislation and political institutions in many directions, reforms long overdue in civil and criminal jurisprudence being carried out under its influence. The 'Philosophic Radicals' who led the agitation in favour of the repeal of the Corn Laws appealed for support to the principles of utilitarianism. Ricardo, James Mill and his son John Stuart Mill, and other economists were profoundly imbued with the teachings of Bentham, which expressed admirably that spirit of wholehearted and uncompromising individualism so characteristic of this period.

It is now generally recognized, however, that utilitarianism, both as a philosophical and an ethical system, is open to serious criticism. The phrase "the greatest good of the greatest number" is so vague and equivocal as to be practically devoid of all value if it is analysed, while the deduction that this will be brought about by the unfettered pursuit by each individual of his own happiness is indefensible. A considerable part of the legislation of the second half of the nineteenth century has been devoted to restraining people from injuring the general interest in their efforts to benefit themselves.—BIBLIOGRAPHY: E. Albee, *History of English Utilitarianism*; Leslie Stephen, *English Utilitarians*.

Utopia (Gr. *ou*, no, *topos*, place), the name of a political romance written by Sir Thomas More in 1516, and translated into English by Ralph Robinson in 1551, and by Bishop Burnet in 1683. The author applied the name of Utopia to an imaginary island, which he represents as discovered by a supposed companion of Amerigo Vespucci, and where the inhabitants were supposed to live under the most happy conditions, based on the community of goods. The terms Utopia and Utopian are now applied to any imaginary state where things are perfect, and to every conception of a moral or social order which is absolutely impracticable, like Aristophanes's Nephelococcugia (Cloud-cuckoo town). Among other works similar to More's *Utopia* are: Plato's *Republic*, Bacon's *New Atlantis* (1624–9), Campanella's *City of the Sun* (1623), James Harrington's *Oceana* (1656), Cabet's *Voyage en Icarie* (1840), William Morris's *News from Nowhere* (1890), and Hertzka's *Freiland* (1891).

Utrecht, a province of the Netherlands, the smallest in the kingdom; area, 525 sq. miles; pop. 335,461. It is mainly flat, and is traversed by the ridge or plateau of gravel which forms the Rhine-Elm watershed. The province drains to the Elm, which is entirely within it, and to the Rhine, which does not enter it at all. Utrecht is the capital; Amersfoort (pop. 30,000), Bunschoten (a Zuider Zee fishing-town), Doorn, Amerongen, and Zeist are other notable places. Agriculture, dairying (including the making of Gouda cheese), and fruit-growing are the chief industries.

Utrecht, a city of the Netherlands, capital of the province of Utrecht, on the Crooked Rhine at its bifurcation into Vecht and Old Rhine; an important junction on the main lines from Hoek van Holland to Vienna, Berlin, &c., for Boxtel (38 miles, via s'Hertogenbosch for Zwaluwe), Zwolle (for Groningen), Baarn, The Hague, Emmerich, and Amsterdam. It is actually the nodal point upon which the Dutch railway system is built up. An extensive trade in grain and cattle, and in Utrecht velvet, carpets, floorcloth, cottons, linens, chemicals, &c., is carried on. Utrecht is the oldest town of Holland, and was called by the Romans *Trajectum ad Rhenum*, that is, 'Ford of the Rhine', and later *Ultrajectum*. Pop. 140,500.

Utrecht, Peace of, a series of separate treaties agreed upon at Utrecht by the Powers which had been engaged in the War of the Spanish Succession. On 11th of April, 1713, the States-General, Prussia, Portugal, and Savoy, signed separate treaties with France. The emperor refused to accede to the peace, and his differences with France were subsequently adjusted by the Treaties of Rastadt and Baden in 1714. By the treaty with England, France, among other things, recognized the Hanoverian succession, engaged never to unite the crowns of France and Spain, and ceded to Britain Nova Scotia, Newfoundland, St. Kitt's, and Hudson Bay and Straits. Gibraltar and Minorca were also ceded on behalf of Spain. Holland retained the Spanish Netherlands until a barrier treaty was arranged with Austria. Louis XIV recognized the title of the King of Prussia, who received a part of Spanish Gelderland, and the sovereignty of Neuchâtel in Switzerland, while renouncing the principality of Orange. Savoy and Nice were restored to the Duke of Savoy, who was recognized as presumptive heir to the Spanish monarchy, and received the title of king. Philip V was not recognized till the conclusion of these treaties, but France treated for Spain, and formal treaties corresponding with those with France were afterwards signed with that Power.

Utrera, a town of Spain, in the province of Sevilla; served by the railway Sevilla-Cadiz (95 miles), and the line (69 miles) from Utrera to La Roda, a junction on the line Malaga-Cordoba (120 miles). Utrera lies on a fertile plain, and has oil and wine manufactures, and animals are bred locally for bull-fighting purposes. Pop. 18,000.

Uttoxeter, an ancient town of Staffordshire, England. It is the Saxon *Uttoceaster*, which passed to one de Ferrers at the Norman Conquest, and ultimately became the property of John of Gaunt and, later, of the Talbots. About 1205 one of the Ferrers raised Uttoxeter to borough rank. Agricultural implements, nails, and beer are among its manufactures. Pop. (1921), 8805.

Uxbridge, a town of Middlesex, England, on the Colne, 15 miles west of London. It has an iron-foundry, breweries, brick-kilns, &c. Pop. (1921), 12,923. Uxbridge was anciently known as Waxbreuge, Woxebrugge, and Oxburge, i.e. Great Bridge, and is said to have been founded by Alfred. It was the scene of negotiations between Charles I and Parliament in 1645.

Uxmal, a ruined Maya city in the Mexican state of Yucatan, near Ticul (q.v.). There are several buildings in a fine state of preservation, and noted for their relief work and general ornamentation. All the ruins date from the thirteenth or fourteenth centuries. See *Mayas*.—Cf. Charnay, *Les anciennes villes du Nouveau Monde*.

Uzbegs, the Transoxiana group of the Turkish division of the Turanian peoples. The group inhabits part of Turkestan north of the Turkmens country, and, while it overflows into Northern Afghanistan, its main distribution is confined to the region lying astride the Oxus and south of the Aral Sea. All the Uzbegs, about 800,000 in number, are classed as Central Asian Turks. Nearly 500,000 of them are found in Samarkand and 200,000 in Northern Afghanistan. Khiva is over 60 per cent, and Bukhāra 30 per cent, Uzbeg, and the group has an overwhelming majority in Samarkand, and in parts of Ferghana and Syr Darya. Some of the Uzbegs are nomadic, but the majority are exceptionally fine agriculturists, although, at the same time, they have the usual Turkish ability as soldiers. Their Muslim faith, centuries old, is still tinctured with the customs and manners of pre-Islamic barbarity. The universal language is Jagatai, and there is a popular literature.

V

V, the twenty-second letter of the English alphabet, a labial, formed by the junction of the upper teeth with the lower lip, and a gentle expiration. It resembles the letter *f*, but is *sonant* and not, like it, *surd* or *hard*.

Vaal River, a river of South Africa, rises in the Drakensberg, separates the Transvaal and Orange Free State, and enters the Orange River, of which it is the chief tributary; length, 500 miles.

Vaccination, a method of inoculating man with vaccinia or cow-pox to protect against smallpox. Jenner in 1796 introduced vaccination into England, but prior to that time inoculation of smallpox itself had been practised. Early in the nineteenth century, however, vaccination rapidly replaced the older inoculation, and by the first Vaccination Act (1840) it was provided free by the State. Exemption on conscientious grounds was granted in 1898, and in 1907 it was made easier to obtain exemption. Revaccination is not compulsory in this country. Vaccination may be performed on any part of the skin, but the usual site is the left arm. The skin is suitably prepared and then scraped, and the lymph rubbed into the scarified areas. A person should not be regarded as insusceptible to vaccinia till the process has been repeated unsuccessfully at least three times. The outstanding arguments in favour of vaccination are that prior to its general introduction in infancy smallpox was pre-eminently a disease of childhood, like measles to-day, and it is estimated that in pre-vaccination days one-twelfth of all children died from smallpox. Now the great majority of patients in a smallpox hospital are adults. Further, in those children who have been vaccinated and yet take smallpox, it is of a much milder character than in the unvaccinated, while the immunity of the recently vaccinated or revaccinated in an epidemic is striking. Opponents of vaccination have urged that the decline in smallpox is due to improved sanitation and not to the protection of vaccination.

Vacha, a town of Thuringia, Germany, on the Werra; the junction for Salzungen, on the Gerstungen-Mansbach Railway. Paper, agricultural machinery, &c., are made. Pop. 5000.

Vacuum Cleaner, an appliance for the extraction of dust from within the texture of such fabrics as carpets and upholstery as well as for the removal of surface material. The partial vacuum used is obtained by the operation of bellows actuated from the wheels during running or by means of a small electric motor.

Vacuum Tube, a glass vessel fitted with two electrodes and provided with means of connection to a high-vacuum pump (see *Air-pump*). When an active induction coil is connected to the electrodes of a long vacuum tube containing air at ordinary pressure, beautiful optical phenomena are observed as the vacuum is being established. No discharge takes place till the pressure is diminished to about a fifth of an atmosphere. The luminosity of the tube is at a maximum at a pressure of about 1 cm. of mercury. On further reduction of the pressure, the luminous column, known as the positive column, retreats from the cathode and breaks into layers or striæ; a dark space—the Faraday dark space—becomes evident between the positive column and the bluish light near the cathode, called the negative glow; and a dark layer, known as the Crookes dark space, develops round the cathode; a luminous layer surrounds the cathode itself. The pressure is now about 1 mm. of mercury. As the pressure is further diminished, the positive column disappears, the negative glow fills the tube near the cathode, and the Crookes dark space expands towards the walls of the tube, which begin to glow with a pale-green fluorescence. The air pressure is about $\frac{1}{10}$th mm. On further increasing the vacuum, the Crookes dark space expands and the fluorescence of the glass tube increases in brilliancy; the pressure has now been reduced to about $\frac{1}{1000}$th mm. The conductivity of the gas has now begun to decrease, and by reducing the pressure to about $\frac{1}{20000}$th mm., the vacuum becomes non-conducting, and the discharge ceases.

The discharge through the tube takes place by a process of convection. Crookes showed that in a tube at the fluorescent stage (Crookes' tube) the discharge was accompanied by a stream of 'radiant matter' from the cathode, the particle of which is now known as an *electron* (q.v.). Besides the stream of electrons, there is also a stream of positively charged gaseous particles from the anode. These move with much smaller speed than the electrons, but are also subject to deflection by magnetic and electrostatic fields; they have been called canal rays and positive rays. The electric discharge appears to depend on the collisions of positive ions with the cathode.

Vagrants, a class of persons of which the English law takes cognizance, the statutes dividing them into three grades: (*a*) idle and disorderly persons, liable to a month's imprisonment with hard labour; (*b*) rogues and vagabonds, liable to three months' imprisonment with hard labour; (*c*) incorrigible rogues, liable to twelve months' imprisonment with hard labour.

Vág-Újhely (Ger. *Waag-Neustadtl*; Slovak. *Novomesto*); a town of Czecho-Slovakia, on the Vág (Waag); served by the Pressburg-Trencsin railway. There are grain, wool, and leather markets; horseshoes are made, and there are distilleries and breweries. Pop. 6000.

Valais (vȧ-lā; Ger. *Wallis*), a southern canton of Switzerland, abutting on France and Italy; area, 2027 sq. miles. It is surrounded on all sides by sections of the Alps, with ridges 18,000 to 15,000 feet high, and magnificent glaciers. The Rhône traverses the whole length of the canton, forming the largest valley in Switzerland. The mountain slopes are afforested. Rich pastures support numerous cattle, the chief source of subsistence of the inhabitants; and in the lower valley of the Rhône there is much arable land, the finer fruits are grown, and silk-worms reared. Wine is produced. In the Upper Valais German, in the Lower French is spoken. The canton was admitted into the Confederation in 1553. Sion is the capital. Pop. (1920), 128,246.

Valdai Hills or **Plateau**, an elevated region of Western Russia, in the former government of Novgorod. They form part of the Plateau of Central Russia.

Valdepeñas (vál-de-pen'yás), a town of Spain, in the province of Ciudad-Real; a junction for Puertollano on the Madrid-Sevilla Railway. It is celebrated for red wine, and has iron-springs and bathing establishments. Pop. 23,580.—Valdepeñas (de Jaen) is another town in Jaen province. Pop. 5000.

Val de Travers (vál dė trá-vär), a valley in the Swiss Jura, canton of Neuchâtel, drained by the Areuse flowing into the Lake of Neuchâtel. It is cultivated in parts, and there are important deposits of asphalt at St. Sulpice.

Valdivia, a province of Chile, lying between Cautin (north) and Llanquihué (south). In the east it is flanked by the Andes, among the foot-hills of which is a chain of lakes. Lake Rinihue is drained by the Valdivia River (100 miles), which, with its chief northern affluent, the Rio Croces, drains the most of the province. On it stands Valdivia, the capital (pop. 20,000), a busy manufacturing town (beer, leather, oils, ships, &c.), some 12 miles north of Porto de Corral, its port. Valdivia, town and province, has a large German element in its population. Lumbering and the clearing of land are prominent industries, which pave the way for the coming of the agriculturist and abundant crops of wheat. Leather, flour, beer, cattle, and timber are among exports. Area, 8991 sq. miles; pop. 175,200.

Valdorf, a town in the Prussian province of Westphalia, on the Herford-Vlotho Railway. It has mineral springs and baths. Pop. 6000.

Valence (Rom. *Julia Valentia*), chief town of the department of Drôme, France, on the Rhône; a junction on the P. L. M. Railway for Grenoble. It has an ancient Romanesque cathedral (S. Apollinaire), consecrated by Pope Urban II in 1095. Manufactures include silks, beer, confections and jam, brandy, furniture, and leather, and there is a busy river trade. Pop. 28,700.

Valencia, a maritime province of Eastern Spain. Physically it comprises a low seaboard fringed with sand-dunes, which have enclosed the Pool or *Albufera* of Valencia, and backed by a low coastal plain, which is flanked in the hinterland by highlands attaining, in parts, 4000 feet altitude, the whole province draining to the Mediterranean by the Guadalaviar and Jucar river-systems. On the coastal plain, where the climate is warm and dry, cereals, fruit, and oil are produced, and in the lacustrine areas near the sea rice is grown. Sericulture is progressive. In parts of the highlands the vine flourishes, and elsewhere sheep and goats are raised. Fishing around the coast, and iron-founding, distilling, and oil-refining are other important occupations. Valencia is the capital; other towns are Alcira, Jativa, Cullera, Requena, and Utiel. Valencia is the railway nodal point, whence a network covers the province. Among others, lines run to Tarragona (171 miles by coastal route), Calatayud (183 miles; the junction for Zaragozá-Madrid), La Encina, via Alcira and Jativa (for Alcoy, 40 miles) (70 miles; the junction for Madrid-Alicante), and Liria (a circular route, via Manises or via Paterna). Area, 4150 sq. miles; pop. 920,000. See *Utiel*; *Teruel*.

Valencia, a city of Spain, capital of the province of Valencia, on the Guadalaviar. It is an archbishop's see, and has a cathedral (greatly injured by modernization), a royal palace, an exchange, a general hospital, an academy of the fine arts, and other institutions. The university was founded in 1411. Other features are the bull-ring, a botanic garden, and the Alameda, a delightful walk bordered with orange, pomegranate, and palm trees. The chief manufactures are silk, linen, hemp, glass, cigars, paper, and soap. Valencia was founded by Junius Brutus, 140 B.C. Pop. 244,000.

Valencia, a city of Venezuela, capital of the state of Carabobo; served by rail to the first-class port of Puerto Cabello (34 miles), and by a second railway to Caracas. The city stands in the Maritime Alps near the west shore of Lake Tacarigua (or Valencia), which has an altitude of 1350 feet and an area of 216 sq. miles. A steamer plies daily. Valencia is the centre of a thriving agricultural region producing sugar-cane, coffee, &c., and has manufactures of agricultural implements and machinery, and woollens. There is a large trade. Near by are the thermal springs of Las Trincheras. The climate is mild; mean annual temperature, 76° F. Valencia was founded in 1555. Pop. about 30,000.

Valencia de Alcantara, a town of Spain, in the province of Caceres, near the Portuguese frontier. It is an important frontier station and customs house on the trunk line Lisbon-Madrid, some 168 miles from the former and 250 miles from the latter. There are neighbouring phosphate-workings, and the Roman aqueduct (still in use) is of great interest. Pop. 10,000.

Valenciennes (vá-lan̦-syen), a town of France, in the department of Nord, on the Scheldt. It is a busy industrial centre, and has forges, foundries, steelworks, &c. Valenciennes was occupied by the Germans during the European

War, but was retaken by Canadian troops on 4th Nov., 1918. Pop. 34,800.

Valency, in chemistry, a number expressing the combining power of an atom or radicle. Elementary explanations are given in the article *Chemistry*, and modern theories are referred to in the articles *Matter* and *Ionization*. Many elements show varying valency—there are, for example, both ferrous and ferric salts. In certain groups of the periodic system (see *Periodic Table*) the sum of the hydrogen and the oxygen valencies of an element is eight, as in the pairs of compounds SiH_4, SiO_2; PH_3, P_2O_5; SH_2, SO_3; and ClH, Cl_2O_7. Abegg was thus led to the theory that every element possesses a maximum valency of eight, made up of *normal* and *contra*-valencies. For P, S, and Cl, these are -3, $+5$; -2, $+6$; and -1, $+7$; so that sulphur, for instance, having a negative valency of 2, but a positive valency of 6, combines with two atoms of hydrogen, but with three of oxygen. In the most recent theory of atomic structure, the valency of the atom is supposed to be controlled by a certain number of its free or planetary electrons, by those, namely, which occupy the outermost of the series of shells in which the free electrons are arranged round the nucleus. The most stable arrangement is one in which the number of electrons in the outer shell is *eight*, and in many important cases chemical combination is due to the tendency of an atom to pick up or to part with electrons till this number is reached. Certain elements, such as argon, have eight electrons in the outer shell in their ordinary state, and are therefore exceedingly stable and chemically inert; potassium has one, and chlorine seven. In KCl, the single electron from K is transferred to Cl, the outer shell of which thus obtains its full complement; the atoms are then oppositely charged, and attract each other electrostatically. This is an example of what Langmuir calls *electro-valence*, which he contrasts with the *co-valence* manifested when the outer shells of two atoms or radicles in chemical combination hold electrons in common. An atom of fluorine, for example, has seven outer electrons, which we may suppose to occupy seven of the eight corners of a cube. The formation of the molecule of F_2 is explained by supposing the atomic cubes to be so arranged in pairs that the empty corner of each cube of a pair is attached to an occupied corner of the other, with the result that each atom has its eight corners filled, and each pair constitutes a highly stable molecule.

Valens, Flavius, Roman Emperor of the East, born in Pannonia in A.D. 328, and declared Emperor of the East by his brother Valentinian I, who had already been elected emperor. The chief event of his reign was the war with the Goths under Athanaric, which lasted during the whole of Valens's reign. The Goths were several times defeated, and sued for peace, which was granted them (370). In 377 the Goths, driven southwards by the Huns, asked and received permission to settle on Roman territory. Irritated by the treatment they received at the hands of the imperial officials, they soon took up arms, and in 378 defeated Valens and destroyed the greater part of his army. Valens was never seen or heard of afterwards.

Valentia, or **Valencia**, a small island off the south-west coast of Ireland, belonging to County Kerry, about 5 miles long by 2 miles broad. It has slate- and flag-quarries, and productive fisheries. The British Atlantic telegraph cables to Newfoundland start from Valentia.

Valentine, St., a saint of the Roman calendar, said to have been martyred in A.D. 306. The custom of choosing valentines on his day (14th Feb.) has been accidentally associated with his name. On the eve of St. Valentine's day young people of both sexes used to meet, and each of them drew one by lot from a number of names of the opposite sex, which were put into a common receptacle. Each gentleman thus got a lady for his valentine, and became the valentine of a lady. The gentlemen remained bound to the service of their valentines for a year. A similar custom prevailed in the Roman Lupercalia, to which the modern custom has, with probability, been traced. The day used to be celebrated by sending anonymously through the post sentimental or ludicrous missives specially prepared for the purpose. But the practice died out about 1880.

Valenza, a city of Piedmont, North Italy, in the province of Alessandria, on the Po. It has a cathedral of the sixteenth century. Pop. 11,000.

Valerian (*Valeriāna officinālis*), a plant of the order Valerianaceæ, native of Europe, which grows abundantly by the sides of rivers, and in ditches and moist woods in Great Britain. The root has a very strong smell, which is dependent on a volatile oil. It is used in medicine, in the form of infusion, decoction, or tincture, as a nervous stimulant and antispasmodic. Cats and rats are very fond of valerian.

Valeria'nus, Publius Licinius, Roman emperor from A.D. 253 to 260. He was taken prisoner by the Persians in 260, and his after fate is unknown.

Valerius Flaccus, Gaius, Roman poet, flourished in the reigns of Vespasian and Titus. Nothing is known about his life, but as Quintilian, writing in A.D. 90, says "We have recently had a great loss in Valerius Flaccus", he must have died about A.D. 89. His epic poem the *Argonautica* was written between A.D. 70 and A.D. 79, and was dedicated to Vespasian. It is in eight books, but the last book ends abruptly, though it is uncertain whether it was never finished or whether the concluding books are lost. It was probably meant to be in twelve books, to bring it into line with the *Æneid*. Valerius Flaccus borrowed his metre and diction from Virgil and his subject-matter from Apollonius Rhodius. He hardly equals the latter, let alone the former. His work is free from glaring faults, but he has too good a memory and too little imagination. He is dull, artificial, and unseasonably learned. The *Argonautica* is an example of mediocrity; at its best silver, at its worst leaden.—Cf. W. C. Summers, *A Study of the Argonautica of Valerius Flaccus.*

Valerius Maximus, Roman author, who in about 30 A.D. compiled a collection of historical anecdotes entitled *De Factis Dictisque Memorabilibus Libri IX*. This book, though not entirely devoid of historical value, was intended to provide rhetoricians with an easy means of pointing a moral and adorning a tale. The style of Valerius is gaudy and rhetorical, and forms a striking contrast to that of Cicero.

Valet'ta, or **Valletta**, the capital of Malta, on the north-east coast, situated on an elevated neck of land, with a large and commodious harbour on each side. From the inequality of the site the communication between the different streets is maintained by flights of steps. The cathedral, built in 1580, contains the tombs of the Knights of Malta or of St. John, and in a chapel are the keys of Jerusalem, Acre, and Rhodes. Other notable buildings are the Governor's residence, formerly the palace of the grand masters; the library, museum, university, and the military hospital. The dockyard is capable of admitting the largest men-of-war. Some shipbuilding and various other industries are carried on, and the trade includes grain, wine, fruits, cotton and other manufactures, coals, &c. The mail steamers for Alexandria, Constantinople, &c., call here, and it is the chief station of the British fleet in the Mediterranean. The town was named after Jean Parisot de la Valette, Grand Master of the Knights of St. John of Jerusalem (1498–1568). Pop. 75,000.

Valguarnera, a town of Sicily, in the province of Caltanisetta; served by the Piazza Armerina branch of the Catania-Palermo Railway from Dittaino junction. Sulphur and olive-oil are produced. Pop. 14,000.

Valhalla (*valhöll*, hall of the slain), in Old Norse mythology, the abode of Odin in Asgard, the palace of immortality, inhabited by the souls of heroes slain in battle, who here spent much of their time in drinking and feasting. It stood in *Gladsheim*, the home of joy. The name is applied figuratively to any edifice which is the final resting-place of many of the heroes or great men of a nation, and specifically to an edifice built by Ludwig I of Bavaria, a few miles from Ratisbon.

Valkyr'ias (Ice. *valkyriur*, choosers of the slain), in Northern mythology, the fatal sisters of Odin, usually nine in number. They are represented as awful and beautiful maidens, who, mounted on swift horses and holding drawn swords in their hands, presided over the field of battle. They selected those destined to death and conducted them to Valhalla, where they ministered at their feasts, serving them with mead and ale in skulls.

Valladolid (vȧl-yȧ-do-lid'), a city of Spain, capital of the province of Valladolid. It has a cathedral, many churches and suppressed convents, and three hospitals. The university, which dates from 1346, was famous until the eighteenth century. It has six faculties and about 4600 students. Manufactures include silks, cotton and woollen goods, hats, jewellery, and paper. Pop. (1918), 69,799.

Vallejo, a seaport-city of California, United States, in Solano county, on an arm of San Pablo Bay; served by the Southern Pacific Railway. It has a spacious harbour, and near it is Mare Island navy-yard. Large quantities of grain are shipped. The city was founded in 1851, and was the state capital till 1858. Pop. (1920), 21,000.

Valleyfield, a town of Beauharnois county, Quebec, Canada, on the Grand Trunk Railway, and served by steamers to Quebec, Montreal, Toronto, &c. It is the western terminus of Beauharnois Canal, and has cotton-mills, flour-mills, machine-shops, and foundries. Pop. 10,000.

Valleys. See *Geography* (*Surface of the Earth*).

Vallisne'ria, a genus of aquatic plants, of the nat. ord. Hydrocharidaceæ. They grow at the bottom of the water, and the male and female flowers are separate. When the time of fecundation arrives, the male flowers become detached and float on the water; the female flowers develop long spiral peduncles, by means of which they reach the surface, where they are fertilized by the male flowers. *V. spirālis* grows in still waters in Italy, and in the Rhone; it is commonly grown in aquaria.

Vallombro'sa, formerly an abbey in a wooded valley of the Apennines, belonging to the diocese of Fiesole, in the Florentine territory, where Giovanni Gualberto founded a house for monks in 1038, subject to the rule of St. Benedict. The building (dating from 1637) accommodates since 1870 an institute of forestry. Vallombrosa was visited by Dante, and is mentioned by Ariosto in *Orlando Furioso*, and by Milton in *Paradise Lost*.

Valmy, a village of France, in the department of Marne, celebrated for the affair known as 'the cannonade of Valmy', where the French Republican troops under Kellermann defeated the Prussians in 1792. Kellermann was made Duc de Valmy in 1809.

Valo'nia, a substance used chiefly in tanning operations. See *Acorn*; *Greece* (section *Vegetation*).

Valparaiso, a mountainous province of Chile, drained mainly by the Aconcagua. Cultivation is more or less confined to the river valleys, where the soil is rich, that of the Aconcagua around Quillota being especially notable. Valparaiso is the capital; Quillota, Limache, and Viña del Mar (a suburb of Valparaiso) are other places, all of which are connected by rail. Valparaiso is the western terminal of the great Transandine trunk line from Buenos Aires. Area, 1775 sq. miles; pop. 321,000 (the most densely peopled province of Chile).

Valparaiso, a city and seaport of Chile; the largest and most important port on the west coast of South America, the second city of Chile, and capital of the province of Valparaiso. It is built round the encircling hills (about 1200 feet) that fringe the meagre sands of a semicircular bay, and it is largely a city of merchants and traders—the Liverpool of South America. There are State railway shops, foundries, and machine-shops, and many small industrial concerns; but the main business of the city is transport, and its activities have been stimulated by the great increase of traffic now coming over the Transandine line and avoiding either the dangers of the Strait of Magellan or the lengthy circuit of the Panama Canal. The main railway runs to Santiago, some 120 miles distant. Many steamship lines serve the port.

Valparaiso was founded in 1536, and the name means literally 'The Valley of Paradise'. The city has suffered much from earthquakes, and despite its prosperity it is still far from being what its name proclaims. Pop. 182,300.

Valparaiso, a city of Indiana, United States, the county seat of Porter county; served by the Grand Trunk, Pennsylvania, and other railways. It is the seat of a university. Settled in 1835, it became a city in 1865. Pop. 9000.

Valsa, a large genus of ascomycetous Fungi, group Pyrenomycetes, family Sphæriales, comprising some 400 species, mostly saprophytes on dead twigs.

Valuation is the process of ascertaining the capital value, or the yearly value, of property. It is done by professional valuators or appraisers for a variety of purposes, e.g. to guide a prospective seller as to the market value of the subjects he proposes to sell, or a prospective purchaser as to the price he should pay; to advise trustees and others as to the extent to which they may safely lend on real or heritable security; to determine the taxation to which property is liable, e.g. on a death, or for property tax, inhabited house duty, local rates, &c.; to determine yearly rent; to assess compensation for dilapidations or for compulsory acquisition, &c. Valuations are liable to stamp duties varying from 3*d.* where the value does not exceed £5 to 20*s.* where it exceeds £500, unless made for the information of one party only and not obligatory between parties, or made under order of the Court of Admiralty, or for the payment of death duties or income tax, or in a bankruptcy. The cost of the licence which every valuator other than an auctioneer or an attorney must take out annually is £2. See *Rates*.

Value. The significance which can be assigned to the word 'value' in economics is so variable that modern economists are often inclined to avoid the word altogether, and to use instead such words as 'price' and 'utility'. "The word value", said Adam Smith, "has two different meanings, and sometimes expresses the utility of some particular object and sometimes the power of purchasing other goods which the possession of that object conveys." The confusion arising in this way between intrinsic or utility value on the one hand, and exchange value on the other, has led to much fruitless controversy. It must never be forgotten that the price, i.e. the exchange value, of a commodity is determined by the interaction of demand and supply, and just as supply depends ultimately upon cost of production, so demand depends upon utility, i.e. intrinsic value. As the supply of any commodity increases, however, its marginal utility diminishes. Thus, in circumstances when only a quart of water is obtainable, its exchange value will be extremely high. An increase in the supply will not diminish the absolute utility of that first quart, but the marginal utility, and consequently the exchange value of the last quart, will diminish rapidly. This, very briefly, is the modern economic theory of value.

Valves and Valve Gears. A valve is a contrivance by which the flow of a liquid or a gas through a pipe may be regulated by a movable part which opens or closes the passage way. The hinged or reflux valve, the butterfly valve, mushroom valve, double-beat valve, and disc valve are a few of the automatic types in every-day use. Among non-automatic valves are stop valves, reducing valves, and throttle valves. The stop valve consists of an ordinary lift valve opened or shut by means of a screwed spindle which works in a nut in the body of the valve. The reducing valve is used to reduce the pressure of a gas below that of the main supply. The throttle valve, which is generally an elliptical plate fixed upon a central spindle, is used to reduce the speed of an engine by checking the flow of steam or gas.

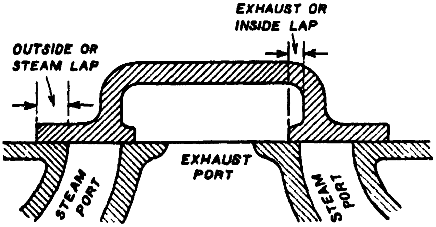


Fig. 1

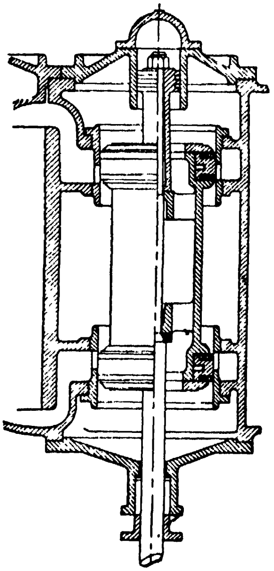


Fig. 2

In fig. 1 is shown a simple slide valve as used in a steam-engine for distributing the steam to the cylinder. It consists of a dish-shaped rectangular casting, the face of which slides backward and forward on a seating formed in the steam chest. When the valve is placed in its mid position, the distance that the outer edge extends beyond the outer edge of the steam port is called the outside or steam lap, and the distance that the inner edge extends beyond the inner edge of the port is called the inside or exhaust lap. It is customary in large engines to use relief frames at the back of the slide valve to prevent loss of power necessary to overcome friction. This loss is further reduced by making the valve double-ported or by using a trick valve. In Meyer's expansion valve the cut off can be varied while the engine is running. When high-pressure steam is used, the slide valve has to give place to the piston valve (fig. 2), or to the drop valve, which is well balanced and easy to operate. Rocking valves are used with the Corliss valve gear, giving a sharp cut off. In the Stephenson link motion (fig. 3) two eccentrics are used. The eccentric rods are connected by a slotted link curved to a radius equal to the length of a rod; this link can be moved up or down by a lifting link. The valve rod end is coupled to a die-block which slides within the slotted link, and when the link is lifted to bring the forward eccentric into line with the die, the valve moves as if operated directly by a single eccentric; similarly for backward gear. In Hackworth's gear a single eccentric is used opposite the crank with an eccentric rod whose mean position is perpendicular to the travel of the valve. In the Joy gear no eccentric is used. The rod corresponding to Hackworth's gear receives its motion from a point on the connecting-rod. In the Walschaert gear (fig. 4) the valve receives its motion from an eccentric which actuates a rocking link.

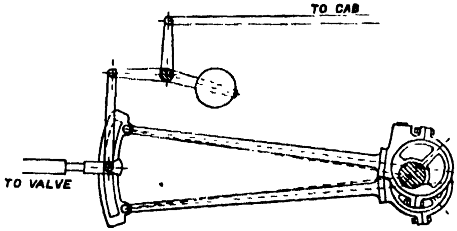


Fig. 3

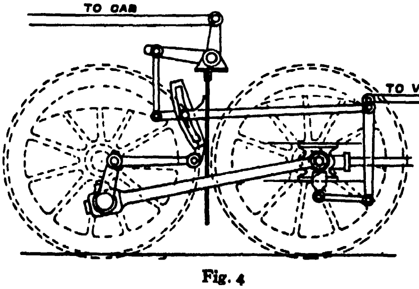


Fig. 4

Vambéry, Arminius, Hungarian traveller and scholar, born in 1832, died in 1913. He studied at Pressburg, Vienna, and Budapest, and then went to Constantinople, where he lived by teaching French. From 1861 to 1864, disguised as a dervish, he undertook an extensive journey of exploration through Persia into Turkestan, and visited Khiva, Bŭkhara, and Samarkand. In 1865 he became professor of Oriental languages at the University of Budapest. His works include: *Travels in Central Asia* (1865), *Wanderings and Adventures in Persia* (1867), *Islam in the Nineteenth Century* (1875), and *The Coming Struggle for India* (1885). His *Life and Adventures* appeared in 1883, *The Story of My Struggles* in 1904.

Vampire, a superstition of Eastern origin existing among the Slavonic and other races on the Lower Danube. A vampire is a ghost still possessing a human body, which leaves the grave during the night and sucks the blood of living persons, particularly of the young and healthy. Dead wizards, heretics, and such like outcasts become vampires, as does also anyone killed by a vampire. On the discovery of a vampire's grave the corpse must be disinterred, thrust through with a white-thorn stake, and burned.—Bibliography: W. R. S. Ralston, *Russian Folk-tales*; Bram Stoker, *Dracula*.

Vampire-bat, a name for certain bats of the family Phyllostomatidæ, inhabiting South America. The name was given from the blood-sucking habits attributed to these bats, but how many of them really attack animals and suck blood from them is not quite clear. One species at least, known as the vampire-bat (*Vampy̆rus spectrum*), of large size and having formidable teeth, seems to be conclusively acquitted of the charge, its regular food being fruits and insects. It has large leathery ears, an erect spear-like appendage on the tip of the nose, and wings measuring 28 inches when extended. Several bats, however, have been proved to be blood-suckers, the best-known being *Desmŏdus rufus*, a species only about 4 inches long and 15 or 16 inches in expanse of wing. It has large prominent upper incisors of peculiar shape, and upper canines somewhat similar, and the stomach and intestines are evidently specially adapted for a diet of blood. This species of bat seems to be generally distributed throughout the warmer parts of South America from Chile to Guiana. The blood-sucking propensities of these bats are by no means so dangerous as formerly and popularly described; but there is little doubt that they do attack horses and cattle, and even sleeping human beings.

Van, a town of Asia Minor, situated near the eastern shore of Lake Van. Excellent carpets and cotton cloth are made and exported from the Van district, which is especially noted for embroidery and tapestry. Pop. 30,000.—Lake Van is a salt-water lake, 5270 feet above sea-level; area, 1300 sq. miles. It contains many islands, and has no visible outlet.

Vanadinite, an orange-coloured mineral, consisting of vanadate and chloride of lead, isomorphous with apatite, and one of the commercial sources of vanadium.

Vanadium, a metallic element (chemical symbol, V; atomic weight, 51·0), the compounds of which are widely distributed, but in small quantity, in a variety of minerals. Its most abundant ore is *vanadinite*, which contains about 17 per cent of vanadic acid. The metal is silver-white in appearance, and is not easily oxidized in air; its specific gravity is 5·5, and melting-point 1720° C. Small quantities of vanadium (about 0·2 per cent) added to steel increase the tensile strength and elastic limit, and the alloy, called vanadium steel, is used for the construction of springs, car axles, and other parts subject to varying stresses. The compounds of vanadium are poisonous.

Vanbrugh (van-brö′), Sir John, British dramatist and architect, was born in 1664, and died in 1726. His grandfather had migrated to England from Ghent. Vanbrugh was educated at the King's School, Chester, and after visiting France, obtained a commission in the infantry. In 1690 he was arrested on a charge of espionage and spent some time in the Bastille as a prisoner. His earliest comedy, *The Relapse: or, Virtue in Danger*, was produced in 1696. It was a sequel to Cibber's *Love's Last Shift: or, The Fool in Fashion*, but it at once surpassed its forerunner in popularity. Lord Foppington was a famous character; scarcely less so were Miss Hoyden and her father, Sir Tunbelly Clumsey. The play was frequently acted, and was recast by Sheridan as *A Trip to Scarborough*. *Æsop* (1697), a dramatic sermon, was a failure because the sermonizing element outweighed the dramatic. *The Provok'd Wife*, produced in the same year, is perhaps Vanbrugh's masterpiece, and certainly contains his greatest character, Sir John Brute. This play was partly the cause of Collier's unreasonable and unsuccessful attack on the stage. Vanbrugh's next plays were all adaptations: *A Country House* and *The Confederacy* from Dancourt, *Squire Trelooby* from Molière's *Monsieur de Pourceaugnac*, and *The Mistake* from his *Dépit Amoureux*. All these are excellently done, and are not mere journey-work; in many details they improve upon their originals. Vanbrugh's last play, *A Journey to London*, was left incomplete at his death, but was completed and produced by Cibber as *The Provok'd Husband*. Vanbrugh became Comptroller of the Royal Works in 1702, and built Castle Howard for the Earl of Carlisle. His chief architectural works were a theatre in which acoustic requirements were neglected, and Blenheim Palace, which brought him into unpleasant relations with the Duchess of Marlborough, and which was a source of worry, expense, and litigation for years. Lord Carlisle had him made Clarenceux King-at-Arms, and in this capacity he took the insignia of the Garter to the Elector of Hanover, afterwards George I. When George ascended the throne in 1714 he knighted Vanbrugh. Vanbrugh built many other country mansions, and became architect to Greenwich Hospital in 1716. As an architect he seems to have suffered from a kind of megalomania. He was much more successful as a dramatist. The immensity of his Cyclopean architectural work bears no relation to the finish and neatness of his comedies. He was not a literary man or a great stylist; but his active career as man of affairs, soldier, herald, architect, and playwright gave his work in the last-named capacity an inimitable *vis comica.*—BIBLIOGRAPHY: G. H. Lovegrove, *The Life, Work, and Influence of Sir John Vanbrugh*; I. D'Israeli, *Curiosities of Literature*; A. E. H. Swain (editor), *Select Plays of Sir John Vanbrugh* (Mermaid Series).

Van Buren, Martin, eighth President of the United States, born at Kinderhook, New York, 1782, died 1862. He early studied law, and in 1812 was elected to the state Senate. He was Attorney-General from 1815 to 1819, and in 1821 was elected United States Senator. In 1828 he became Governor of New York, and in the following year President Jackson appointed him Secretary of State. In Nov., 1832, he was elected Vice-President, and in 1836 became President of the United States. The difficulties which his administration had to face were chiefly connected with the deposit of State funds in private banks, and his method of dealing with these brought about his defeat at the next election in 1840. He was again nominated by the Democrats in the elections of 1844 and 1848, but was unsuccessful on both occasions. He wrote a treatise entitled *An Inquiry into the Origin and Course of Political Parties in the United States* (1867).

Vancouver, George, English navigator, born about 1758, died 1798. He entered the navy as midshipman in 1771; accompanied Cook on his second and third voyages (1772–4 and 1776–9); was made first-lieutenant in 1780; and served in the West Indies until 1789. In 1790 he was put in command of a small squadron sent to take over Nootka from the Spaniards, and was also charged to ascertain if there was a north-west passage. He sailed in the *Discovery*, 1st April, 1791, spent some time at the Cape, and afterwards made for Australia and New Zealand, parts of the coasts of which he surveyed. Having received formal surrender of Nootka, he spent the summers of 1792–4 in surveying the coast as far north as Cook's Inlet, wintering at the Sandwich Islands. He returned by way of Cape Horn, and reached England in 1795, where a narrative of his voyage was published in 1798. Vancouver Island was named after him.

Vancouver, a city of British Columbia, on Burrard Inlet, which opens on the Strait of Georgia, and forms a fine harbour. It is a terminus of the Canadian Pacific, National, and other railways. There is a large trade with American and Asiatic ports in timber, coal, fruit, &c. Vancouver dates back only to 1885. Pop. (1919), 115,000.

Vancouver Island, an island in the Pacific, off the west coast of British Columbia, of which province of Canada it forms part; length, from 250 to 300 miles; area, 16,400 sq. miles. It is generally mountainous, and heavily timbered. The climate is temperate, and the soil, in the south and east, fertile and favourable to agriculture and fruit-growing. The interior is rocky, interspersed with small grass tracts suitable for pasturage, and with lakes and small streams. Much coal is raised and exported at Nanaimo on the south-east coast, and gold, copper, iron, and other minerals are found. Horses, cattle, and sheep thrive well, and the seas and lakes abound with fish. Salmon are exported, and there is a trade in furs. Settlement is almost confined to the south-east, where are situated Victoria, Esquimault, and Nanaimo, all connected by railway. The first is the capital of British Columbia. Pop. about 50,000.

Vandals, an ancient Teutonic or Germanic people. They were allied to the Goths, lacking, however, the better qualities of the latter, and occupied at an early period the country on the south of the Baltic, between the Oder and the Vistula. At a later period they appear to have descended into Silesia, and subsequently occupied Pannonia, Moravia, and Dacia. In A.D. 406, in conjunction with a German host, they ravaged Gaul, and thence found their way into Spain. After defeating an allied army of Goths and Romans, they seized Sevilla and Carthagena, and, led by Genseric (400–477), crossed to Africa. Here they vanquished the Roman governor (429), and founded a kingdom, which absorbed the greater part of the Roman possessions. Genseric immediately began to revive the maritime glories of Carthage, and extended his conquests to Sicily, Sardinia, and Corsica. He also invaded Italy and sacked Rome in 455. The kingdom of the Vandals was continued under his descendants —Hunneric, his son, who immediately succeeded him; Gundamund, 484; Thrasimund, 496; Hilderic, 523; Gelimer, 530. It was overthrown in 534 by Belisarius, the general of the eastern Emperor Justinian.

Vandamme, Dominique Réné, Comte d'Unebourg, French general, born 1770, died 1830. He entered the army in the ranks at the age of eighteen years and served abroad, returning to

France during the revolutionary period (1792), and espousing the republican cause. In 1799, after a strenuous period of fighting, he became general of division, and subsequently served in succession under Brune, Moreau, and Macdonald, being decorated by Napoleon with the grand-eagle of the Legion of Honour in 1805 for his conspicuous services at Austerlitz. The two following years saw him in command of the 9th Corps (Westphalian) of the Grand Army in Germany and Poland, and his subjugation of Silesia is generally considered his finest military achievement. After the battle of Dresden, Vandamme, whom Napoleon had sent with the 3rd Corps into the mountains, essayed an attack on the flank of the retreating Austrians and Russians, but was overwhelmed at Kulm by weight of numbers and compelled to surrender with 10,000 men (29th Aug., 1813). He was interned until the end of the war, when he returned to France, but rejoined the Napoleonic Eagles during the Hundred Days, commanded the 3rd Corps at Ligny, and after Waterloo (where he was not engaged) he suffered a second exile until 1824.

Vanderbilt, Cornelius, American capitalist, born 1794, died 1877, amassed immense wealth in connection with shipping and railroads, a share of which he left to his eldest son William Henry, born 1821, died 1885, who was supposed at his death to be the wealthiest man in the world. The Vanderbilt University (Methodist Episcopal) at Nashville, Tennessee, was founded by Cornelius Vanderbilt.

Van Dyck (van dīk′), Sir Anthony, Flemish painter, was born at Antwerp 1599, died in London 1641. He studied painting first under Van Balen, and then under Rubens, to whom he acted as assistant. During this period his work is at times almost indistinguishable from that of Rubens, though on the whole less exuberant and more sentimental. About 1621 he went to Italy, working chiefly at Genoa, Venice, and Rome, and about 1627 returned to Antwerp. In Italy, Titian and Tintoretto influenced his colour and use of light and shade, and contributed towards the development of an art marked by dignity, elegance, and great technical accomplishment, which reached maturity during Van Dyck's second stay in Antwerp. In 1682 he was invited to England by Charles I, who appointed him his principal painter-in-ordinary, and bestowed upon him the honour of knighthood, a considerable annuity, and a summer and winter residence. In England he fully maintained his reputation in a series of portraits of Charles I and his court, of which good examples are in the National Gallery and in the Royal Collection; though at times he descended into superficiality and mannerism. Though primarily a painter, Van Dyck was also an accomplished etcher and engraver. In England he founded a tradition in portraiture which more or less persisted for two hundred years after his death.—Bibliography: Lionel Cust, *Anthony Van Dyck*; Max Rooses, *Antoine Van Dyck*.

Vandyke Brown, a pigment obtained from a kind of peat or bog-earth, of a fine, deep, semi-transparent brown colour; so called from its being supposed to be the brown used by Van Dyck in his pictures.

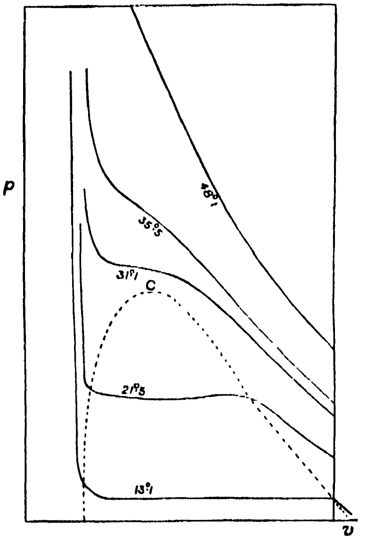
Vane, Sir Henry, English statesman and writer, was born in 1613, died in 1662. The eldest son of Sir Henry Vane, Secretary of State, he was educated at Westminster and Oxford, and afterwards at Geneva, where he became a Puritan. Emigrating to the United States, he was elected Governor of Massachusetts in 1686. In 1637 he returned to England, was knighted, entered Parliament, and became Treasurer of the Navy. He took part in the impeachment of Strafford, and was a zealous supporter of Parliament in the Civil War and one of the leaders in the Long Parliament. He was averse to the execution of the king, and came into conflict with Cromwell in consequence of the forcible dissolution of the Long Parliament (1653). In 1656 he was imprisoned in Carisbrooke Castle for four months, by order of Cromwell, on account of a pamphlet he had written. On his release he continued resolutely to oppose the government of Cromwell and of his son Richard. After the Restoration he was sent to the Tower (Feb., 1660), and subsequently tried for high treason before the Court of King's Bench (2nd June, 1662), condemned, and beheaded on Tower Hill on 14th June.—Cf. John Willcock, *Life of Sir Henry Vane, the Younger, Statesman and Mystic.*

Vanilla, a flavouring agent used in confectionery, and in the preparation of liqueurs, procured from the fruit of *Vanilla planifolia* and allied species, orchidaceous plants of tropical America, remarkable on account of their climbing habit, and now cultivated in various tropical countries, including Ceylon and India. It has a fragrant odour, and is also used in medicine as a stimulant and promoter of digestion.

Vannes (vàn), a seaport of France, capital of the department of Morbihan, Brittany, an interesting old place, now surrounded by modern suburbs. There is a cathedral, and a museum rich in Celtic antiquities. Pop. 25,100.

Vaporization, the process by which a liquid changes into a vapour (see *Evaporation*; *Boiling-point*). One of the earliest experimenters on the relationship between the liquid and gaseous states of matter was Cagniard de la Tour, who heated volatile liquids in very strong closed tubes about half filled. He observed that at certain temperatures (86° C. for alcohol, and 42° C. for ether) the liquid suddenly disappeared, so that at these temperatures the two states were apparently continuous with one another.

The great name, however, in this section of physics is that of Dr. Thomas Andrews (q.v.). By a series of elaborate experiments on carbonic acid, Andrews showed that at a temperature above 31° C. this gas cannot be liquefied by any increase of pressure, but, when the pressure is very great, assumes a condition in which, though uniform throughout, it is neither a liquid nor a gas. The results were shown graphically on a (p, v) diagram (see *Thermodynamics*) in which the isothermals for various temperatures were drawn, somewhat as shown in the figure. The isothermal for 13·1° C. is, to the left, practically a vertical line, the substance being liquid, and the volume hardly diminished even by great increase of pressure; in the middle, it is a horizontal line, implying constant pressure, the liquid being in presence of its saturated vapour; to the right, the substance is entirely gaseous, and the isothermal is approximately a hyperbola, in accordance with Boyle's Law. The same general features appear in the isothermal for 21·5°. But, from 31·1° upwards, the horizontal straight part of the isothermal disappears. This means that the change of volume between the point at which gaseous carbonic acid begins to condense at constant temperature under increasing pressure, and the point at which the gas is completely condensed, i.e. the change of volume between the points where a horizontal line cuts the dotted curve, gets smaller as the temperature rises from low values. The point at which this change of volume disappears entirely, viz. the apex C of the dotted curve in the figure, is called the *critical temperature* of carbonic acid; and the pressure and density at the same point are called the *critical pressure* and *critical density*. See *Steam*.



Isothermals of Carbonic Acid

TABLE OF CRITICAL TEMPERATURES AND PRESSURES

	Temperature (centigrade).	Pressure (atmospheres).
Helium	−268	2·3
Hydrogen	−234·5	20
Nitrogen	−146	33
Air	−140	39
Oxygen	−118	50
Carbon dioxide	31	73
Ammonia	130	115
Sulphur dioxide ..	155	79
Water	365	195

Var, a maritime department in the south-east of France, bordering upon the Mediterranean, and covered in the interior with ramifications of the Alps; area, 2333 sq. miles, of which only a small portion is arable. There are magnificent forests of pine and oak, and the vine, olive, mulberry, and tobacco are extensively cultivated. Minerals include salt, lead, coal, marble, gypsum, and building-stone. The manufactures consist of woollens, perfume, liqueurs, olive-oil, soap, leather, and silk. Fishing (tunny and anchovies) is carried on. Capital Draguignan. Pop. (1921), 322,945. See *Brignoles*; *Hyères*; *Toulon*.

Varangians, the name applied to the Norse vikings, who, at the close of the ninth century, founded various principalities in Russia. The word is derived from the Old Norse *væringjar*, and means retainers. Some of the Varangians afterwards entered the service of the Byzantine emperors, and became the imperial guards at Constantinople. Here they were recruited by Anglo-Saxons and Danes, who fled from England to escape the Norman yoke.

Varasdin, a town of Yugoslavia, in Croatia. It has manufactures of tobacco, liqueurs, vinegar, and silk wares. Pop. 12,000.

Vardar, a river of Yugoslavia (Serbia) and Greece (Macedonia), rising in the grassy plain of Tetovo (behind the Shar Mountains), flowing first in an easterly direction and then south to the plain of Skoplye, passing Skoplye town and the town of Veles, and crossing Macedonia to its delta in the Gulf of Salonika; length, 200 miles. It forms the chief river of Macedonia, and its valley has been for centuries one of the main routes between the Ægean and the Danube. The Tsrna (on the right) and the Lepenats and Bregalnitsa (left) are the chief affluents. Some gold-washing is carried on in the lower reaches. During the European War (q.v.; see sections

The Balkans, 1915 and *The Balkans, 1918*) the Vardar Valley was the scene of heavy fighting.

Vardö, a town and port of North-Eastern Norway, well within the Arctic Circle. It stands on Vardö Island (3 miles broad) on the northern side of the entrance to Varanger Fiord (55 miles long; extreme depth, 230 feet), and the port, ice-free all the year round, is served by steamer to Hammerfest (190 miles). Fish, especially cod from the rich Varanger fisheries, and by-products, such as oil and guano, are exported. The mean annual temperature is 32·7° F. Pop. 3000. Near by is Vardöhus, the most northerly fortress in the world, and one of the smallest, founded in 1310.

Variable Stars. Many stars vary from time to time in their brightness. The most famous is the star β Persei, called by the Arabic name of Algol, the Demon, evidently because the ancients were impressed by its (so to speak) winking eye. This star, which is typical of the regular and short period variables, goes through a constantly repeated set of changes in a period of 2 days 20 hours 48 minutes. For over 2 days it shines as a star of the second magnitude; then it loses in a little over 4 hours about two-thirds of its light, remains at minimum for 20 minutes, and in a little over 4 hours regains its former brightness. The spectroscope shows that the diminution of light is caused by a dark companion. Algol and the dark body revolve round the common centre of gravity, and Algol is partially eclipsed in every revolution.

The long-period variables are in many cases very irregular, both in the brightness of maximum and minimum, and in the period of passing through the phases. The best known is o Ceti, called Mira (the Wonderful). It varies upon an average between the second magnitude and the eighth or ninth, the mean period being 331 days. These variables are certainly not to be explained by eclipses by a dark satellite. According to a theory of Sir Norman Lockyer, they might be due to revolution of a dense swarm of meteors in an elliptic orbit, which render the star's atmosphere incandescent by friction at their closest approach. It is generally considered that the variation is caused by an intrinsic pulsation of the star, possibly even the alternate formation and destruction of a solid crust on a fluid orb.

When minute variations are taken into account, probably by far the greater number of the stars are variables. Our own sun, with its 11-year sunspot fluctuation, doubtless varies continuously in its output of heat and light. For bibliography, see *Stars*.

Variation and Selection. See *Environment*; *Evolution*; *Heredity*; *Mendelism*; *Natural Selection*; *Sexual Selection*.

Variations, Calculus of, a branch of mathematics which deals with a certain type of problem of maxima and minima. An unknown function has to be determined in such a way that a definite integral of given form involving the function and one or more of its derivatives shall have a maximum or minimum value. A celebrated example is the problem of the *brachistochrone*—to find the curve joining two points in a vertical plane along which a heavy particle will descend from the one point to the other in the shortest time. The curve is a cycloid.—Cf. I. Todhunter, *History of the Calculus of Variations.*

Varicose Veins, veins in a diseased state, which become dilated and uneven, and form hard knotty swellings in the situation of their valves. The disease is a common affection of the lower limbs, where sometimes the varix bursts and hæmorrhage takes place. It also occurs in the veins of the scrotum and lower rectum, producing in the latter case bleeding piles. Varicose veins are caused by local obstruction of the circulation of the blood, and are common in pregnancy, while stout people, and those who stand most of the day at work, are apt to suffer from them. The treatment consists in the application of proper bandages, and rest to the limb supported in an elevated position.

Variety, in biology, a subdivision of a species of animals or plants; an individual or group of individuals differing from the rest of the species to which it belongs in minor characters. Varieties are considered as species in the making, and fertile mongrels result from the crossing of allied varieties. Animal varieties are sometimes termed *races*, while those produced by artificial selection are commonly known as *breeds*. See *Species*.

Värmland, or **Vermland**, an inland län or county of Sweden, drained by the Klar. The surface is studded with innumerable lakes, and a large area of Lake Vener is included in the southern end of the län. Carlstad (pop. 20,000) is the capital; other towns are Kil, Deje, and Christinehamn (11,800). Kil is an important junction on the Falun-Göteborg Railway (via Deje) and on the Laxa-Charlottenberg line (for Christiania), via Carlstad (for Filipstad, via Deje) and Christinehamn (for Mora-Noret line). Area, 7459 sq. miles; pop. 281,000.

Varna, a seaport of Bulgaria, on the Black Sea. It has a good harbour, and a large trade with Constantinople in grain. It is the see of a Greek archbishop. It was taken by the Russians in 1828, but restored to Turkey a year later by the Peace of Adrianople. The Crimean expedition sailed from Varna in 1854. Pop. (1920), 50,819.

Varnish, a liquid applied as a thin coating, which, on drying, forms a hard, shining layer protecting the object from atmospheric influences.

(1) *Oil varnishes* consist of non-volatile drying oils, e.g. linseed-oil, which are heated either alone, or more usually with oxidizing substances, such as litharge, manganese salts, &c., to increase the drying properties of the oil. By incorporating a pigment with an oil varnish, a paint is obtained. (2) *Lac varnishes*, or lacquers, are made by dissolving various resins in linseed-oil varnish, and are harder and more durable than the latter. (3) *Volatile varnishes*, such as 'crystal' varnish and 'spirit' varnish, are prepared by dissolving resins, e.g. shellac, sandarac, colophony, or dammar, in oil of turpentine or methylated spirit, or in a mixture of these solvents. These varnishes dry very quickly and give a hard, glossy surface; the addition of a little mastic or boiled linseed-oil renders them less liable to crack.

Varro, Marcus Terentius, one of the most learned men and prolific writers of ancient Rome, born 116 B.C., died 27 B.C. He served in the army, and subsequently filled several public offices. Varro was the intimate friend of Cicero, and was proscribed by Antony, but he escaped and returned to Rome under Augustus. Of his numerous writings, chiefly on language, history, and philosophy, only one has come down to us entire—a treatise upon agriculture (*De Re Rustica*). Fragments of a treatise on the Latin language (*De Lingua Latina*) are also extant.—Cf. J. W. Duff, *A Literary History of Rome.*

Varus, Publius Quintilius, Roman general, celebrated in consequence of the great defeat that he suffered at the hands of Arminius, leader of the Germans. In 7 B.C., having received from Augustus the command to introduce the Roman jurisdiction into the German territory just conquered by Drusus, he was carrying out his mission when he was suddenly attacked by an immense host under Arminius, and his whole army was destroyed. Varus put an end to his own life.

Vasa′ri, Giorgio, Italian painter and architect, but chiefly famous as the biographer of artists, was born at Arezzo in 1512, died at Florence in 1574. He studied under Luca Signorelli, Michelangelo, and Andrea del Sarto. As an architect he showed considerable ability, as exemplified in his designs of the Palazzo degli Uffizi at Florence, and the church of the Badia at Arezzo. His paintings are less successful, as exemplified by his frescoes in the cathedral of Arezzo, in the Palazzo Vecchio in Florence, and in the Vatican; nor are his easel paintings, such as those in S. Croce and S. Maria Novella, Florence, more impressive. His *Vite de' più eccellenti Pittori, Scultori ed Architetti* (Lives of the most excellent Painters, Sculptors, and Architects) is, however, of the greatest interest and value, though containing many errors respecting the earlier masters and showing considerable partiality towards the Tuscan artists. It was first printed in 1550, and an enlarged and improved edition appeared in 1568. A standard edition is that of Milanesi (1878–85). It has been translated into English.

Vascular or **Conducting Tissues**, of plants, comprise (1) the *xylem* or wood, (2) the *phloem* or bast. The most important constituents of xylem are *wood-vessels* or *tracheæ*, long tubes, devoid of living contents, formed by the coalescence of numerous cells through absorption of the end-walls. These are usually accompanied by shorter conducting elements called *tracheïds* with unbroken end-walls; the xylem of most Gymnosperms and Pteridophytes contains tracheïds only. Wood-vessels and tracheïds transport *sap*, i.e. the water with mineral salts in solution absorbed by the roots, to all parts of the plant and especially to the leaves, where the superfluous water is got rid of by evaporation (*transpiration*), and the salts worked up with carbohydrates formed by carbon-assimilation into the various nutritive or *plastic* materials. The chief function of the phloem is to transport these plastic substances to the growing points (*meristems*), the developing flowers and seeds, storage organs, and other parts where they are required for immediate or future use. The most important elements of the phloem are the *sieve-tubes*, long rows of cells with finely perforated end-walls and contents rich in proteins, sugar, &c. These conducting tissues proper, together with other cells, such as fibres (for mechanical support) and parenchyma (for storage, &c.), are regularly associated to form the *vascular bundles* of herbaceous stems, leaves, &c., or the massive *secondary tissues* of woody stems and roots. See *Botany*; *Phloem*; *Xylem.*

Vas′eline, the trade name for a semi-solid, greasy product, usually of a yellow colour, obtained from the higher fractions in the distillation of crude petroleum. It consists of a mixture of hydrocarbons, and is used as a base for ointments, pomades, cold-cream, &c., and for coating surgical instruments and steel surfaces generally to protect them from rust.

Västerbotten, a län or government of Northern Sweden. It is a lumbering region. Umeå (pop. 8000), on Umeå River, is the capital and chief seaport, exporting timber and tar. The mean annual temperature at Umeå is 35·0° F. (Feb., 15·8°; July, 58·2°). Area, 22,749 sq. miles; pop. 185,200.

Västernorrland, a län or government of Central Sweden. It is a lumbering region. Hernösand (q.v.) is the capital (mean annual temperature, 37·4° F.; Feb., 18·0°; July, 59·2°); other towns are Sundsvall (q.v.) and Örnsköldsvik (a port). Area, 9856 sq. miles; pop. 268,100.

Västmanland, a län or government of Central Sweden. Vesterås is the chief town; others are Sala (where argentiferous lead and copper are extracted from the Salberg, Tillberga, Kölback, Köping, and Ryddarhytan. Area, 2608 sq. miles; pop. 169,500.

Vateria, a genus of plants, nat. ord. Dipterocarpaceæ. Two species, *V. indica* and *V. lanceæfolia*, belong to India, forming large trees, valuable both for their timber, and for the products which they yield. *V. indica*, whose timber is much employed in shipbuilding, produces the resin called in India *copal* and in England *gum animé*. It also yields a fatty substance called *piney-tallow*.

Vatican, Palace of the, official residence of the Pope in Rome, and seat of museums and the great Vatican Library. It is built upon the Vatican Hill, from which it received its name, on the opposite side of the river from the bulk of the city, immediately to the north of the cathedral of St. Peter's. The first Pope to build a residence on the site was Symmachus (498–514), but for a long time the Popes resided mainly in the Lateran. After the return of the Popes from Avignon, the Vatican became their permanent residence, although several Popes resided at the Quirinal. The present buildings were begun by Pope Nicholas V (1447–55), and have been enlarged and embellished by many subsequent Popes down to Pius IX. The Vatican now possesses twenty courts and, it is said, over 7000 rooms. Immense treasures are stored in it, with celebrated collections of pictures of many of the great masters, and museums in which all periods of the arts are represented by many of their most perfect productions. Among the noblest art treasures are the frescoes on the ceiling of the Sistine Chapel, painted by Michelangelo; and the frescoes painted by Raphael on the ceilings and walls of certain apartments known as Raphael's *stanze*. The apostolic residence, containing the private apartments of the Pope, is in the eastern wing of the court of St. Damasus.

Library.—The Vatican Library, first constituted by Pope Nicholas V, was added to and enlarged by Leo X, Pius IV, Pius V, and other Popes. It contains now about 35,000 MSS. and about 250,000 printed books.—Cf. D. B. W. Sladen, *How to see the Vatican*.

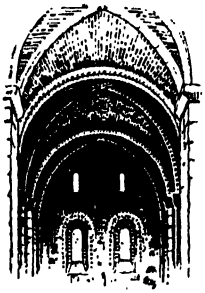
Vauban, Sébastien le Prestre, Seigneur de, French soldier and military engineer, born in 1633, died in 1707. He early entered the army, where he rose to the highest military rank by his merit and services. He was made Governor of the citadel of Lille in 1668, Commissioner-General of Fortifications in 1677, and marshal of France in 1703. As an engineer Vauban carried the art of fortification to a degree of perfection unknown before his time. He strengthened and improved above 300 citadels, erected thirty-three new ones, and directed fifty-three sieges.

Vaucheria, a genus of Green Algæ, group Siphonales. The plants, which consist of rather coarse branched non-septate filaments, grow generally on damp soil, being particularly common on the earth of flower-pots in greenhouses. They are oogamous, a rather unusual feature in the Siphonales.

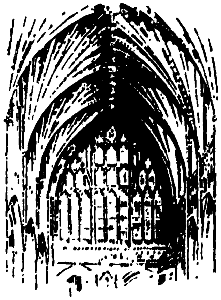
Vaucluse (vō-klüz), a department in the south-east of France; area, 1381 sq. miles. It is rugged and mountainous in the east. The mulberry (for the rearing of silk-worms) and olive are extensively cultivated, and much attention is paid to the culture of aromatic and medicinal plants and of the vine. Vaucluse takes its name from the valley and village of that name, rendered celebrated by Petrarch. Avignon is the capital. Pop. (1921), 219,602.

Vaud, or Pays-de-Vaud (pe-ē-dė-vō; Ger. *Waadt* or *Waadtland*), a western canton of Switzerland; area, 1244 sq. miles. It has three mountain systems—the Alps in the south-east, the Jura in the west, and the Jorat in the south; and partly embraces the Lakes of Geneva and Neuchâtel, belonging both to the basins of the Rhine and the Rhône. The vine is extensively cultivated in the south. There are no manufactures of importance. The people are mostly French-speaking Protestants. Vaud joined the Confederation in 1803. The capital is Lausanne. Pop. (1920), 317,498.

Vault, in architecture, a concave ceiling to a building, formed by a continuous arch or a series of arches in juxtaposition, and constructed with wedge-shaped pieces of stone, brick, or other material, so arranged that they are held together by their mutual pressure and the assistance of mortar or cement. The barrel-vault, the simplest and oldest type, gives a continuous arched roof over the whole length of an interior. It was used

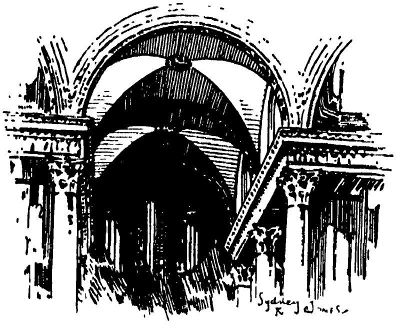


Norman Vault, Stowe, Lincolnshire



Gothic Vault, Exeter Cathedral

by the Romans, who also introduced cross-vaulting, which occurs when a series of vaults intersect the main barrel-vault at right angles. Romanesque builders developed vaulting of the semicircular kind. In the Gothic period the evolution of the pointed arch brought a new era in vaulting, and vaulting-ribs invariably projected beyond the general surfaces of the vaults. During the fourteenth, fifteenth, and sixteenth centuries vaults increased in complexity and elaborate detail, culminating with the fan-vaulting of Tudor days. Domical vaulting is a characteristic feature of Renaissance architecture.



Cross Vault, St. Stephen's, Walbrook, by Sir C. Wren

Vaux, a village of France, in the department of Meuse. It is celebrated for the defence of its fort, from 2nd to 7th June, 1916, during the desperate struggle for Verdun, to which Vaux formed one of the key-positions. See *European War* (section *1916 on the European Fronts*).

Vector, a directed magnitude, such as a displacement, a velocity, or a force. In three-dimensional space, two kinds of vector may be distinguished, typified respectively by a force and by the axis of a couple. The leading properties of these two types are given in the article *Statics*. See *Quaternions*.

Vedanta Philosophy, a system of Brahmanic philosophy, first set forth in a work called the *Vedānta*, said to have been written more than two thousand years ago, and described as containing the quintessence of the *Vedas*. This system is based, like that of the Eleatics among the Greeks, upon the unity of all real existence. The sole real existence is denominated knowledge (*jnāna*), soul, or God. The multiplicity of individual life and variety of external life in the universe is merely phenomenal, and has all proceeded from the one real being by the exercise of the power of ignorance (*ajnāna*), which may be vanquished by a religious and ascetic mode of life, or by meditation on the one supreme spirit, Brahma, and by the extinction of all consciousness of outward things.—Cf. F. Max Müller, *Three Lectures on the Vedanta Philosophy*.

Vedas. *Veda*, literally meaning 'knowledge', denotes the collections of hymns and rituals which form the earliest scripture of the Aryans of India. They comprise (1) *Ṛig-veda*, 'the Veda of the verses', from *ṛich*, 'verse'; (2) *Sāma-veda*, 'Veda of chant'; (8) *Yajur-veda*, 'Veda of sacrificial formulæ'; and (4) *Atharva-veda*, 'Veda of the Atharva priests'.

(1) *Ṛig-veda.*—This is the earliest of the *Vedas*, and probably the oldest work in any Indo-European language. It is of composite origin, including hymns by many generations and of many schools, and probably arose between 2000 and 1000 B.C., apparently in the basin of the Upper Indus and its tributaries. Originally it was transmitted orally, with extraordinary precision, among the various sākhās or schools of Vedic Brahmans; some centuries B.C. it was committed to writing. The Vedic language is related to the classical Sanskrit much as Homeric Greek is to Attic. The Aryan society described in the *Ṛig-veda* is very similar to the Greek world of Homer, being composed of separate and frequently warring tribes, and the unit of society was the patriarchal household. Vedic religion—which was not identical with the popular religion—was in the hands of a class (not yet a fixed caste) of Brahmans, poet-priests who performed on behalf of householders, nobles, and kings various sacrifices and composed hymns for them. The *Ṛig-veda* consists of 10 books or *maṇḍalas*, comprising 1017 hymns (with 11 extra-canonical poems), of which most are ascribed to the seven *ṛishis* or seers Gṛitsamada, Visvāmitra, Vāmadeva, Atri, Bharadvāja, Vasishṭha, and Kaṇva. Most of these hymns are addressed to the chief Vedic deities: the fire-god Agni; Soma, the spirit of the intoxicating draught brewed for ritual use from the *soma* plant; the divine warrior Indra; the Aśvins or twin heroes; various spirits of the sky and upper heaven, such as the wind-god Vāyu, the dawn-goddess Ushas, the sun-god Sūrya, Varuṇa, and Mitra, &c. There are also several philosophical hymns (in book x), and a few poems on legends of myth, certain of which are regarded by some scholars as dramatic.

(2) *Sāma-veda.*—In course of time Vedic rituals, especially those of the Soma-sacrifices, became much more elaborate. Schools of priestly specialists arose, chief being the Hotṛis, who recited verses of the *Ṛig-veda*; the Udgātṛis, who musically chanted them; and the Adhvaryus, who did the manual work of the sacrifice. The Udgātṛis were trained by being taught to chant specimen verses of the *Ṛig-veda* in the tunes appropriate for them; from the collections of these verses arose the *Sāma-veda*.

(3) *Yajur-veda.*—The Adhvaryus accompanied their performance of the rites with formulæ, *yajus*, together with verses from *Ṛig-veda*, &c. These, together with some connected matter, were gathered into a corpus, the *Yajur-veda*, which has come down in five chief recensions.

(4) *Atharva-veda.*—This is a collection of hymns of spells, which has come down in two recensions. The Śaunakīya recension (the *Vulgate*) contains about 6000 verses, of which some 1200 are from the *Ṛig-veda*. The remainder, which is in both verse and prose, is mainly on a lower and more popular level than the *Ṛig-veda*, containing many magic charms and incantations of most diverse kind. Though much of its material is extremely ancient, and the priests professing it had much influence from early times, the *Atharva-veda* was not included until comparatively late in the orthodox Vedic Canon. To it is attached the *Gopatha-brāhmaṇa*, a late work, and some other ancillary literature.—BIBLIOGRAPHY: F. Max Müller, *Sacred Books of the East*; M. Bloomfield, *A Vedic Concordance*; *Religion of the Veda*; A. A. Macdonell, *Vedic Mythology*; *Hymns from the Rig-veda*.

Veddahs, a wild, semi-savage race, according to the census of 1921, 4402 in number, residing in the interior of Ceylon, and said to be a remnant of the pre-Dravidian (proto-Australian) aborigines of Ceylon. The forest Veddahs live in trees and caves and subsist on game, which they kill with bows and arrows. The village Veddahs dwell in certain districts, but hold slight intercourse with the other inhabitants. The two tribes do not intermarry, and they have their own chiefs whom they elect and obey.—Cf. C. G. and B. Z. Seligman, *The Veddas*.

Vega, a town of San Domingo, in the rich *Vega Real*; served by rail to Samana. It was founded in 1570, named after another town founded farther north by Columbus in 1495, and subsequently destroyed by earthquake. Pop. 14,000.

Vega Carpio, Felix Lope de, Spanish poet and dramatist, born in 1562, died in 1635. In 1582 he joined the army, and in 1588 accompanied the Armada. After being twice married and twice a widower, he in 1609 became a priest, and subsequently entered the order of St. Francis. He enjoyed an immense popularity, and is supposed to have written between 1500 and 1800 plays (*comedias*), in addition to several hundred religious pieces (*autos*) and interludes (*entremeses*). Of these there are extant over 400 *comedias* and 50 *autos*. His dramas reveal an inexhaustible but ill-regulated imagination, a strong mixture of the sublime and the ridiculous, and extraordinary facility in versification.—Cf. J. Fitzmaurice-Kelly, *Lope de Vega and the Spanish Drama*.

Vegetarianism, a dietetic innovation dating from about 1847. Its strictest followers reject all animal food; others allow the use of butter, milk, and eggs, no suffering being involved in their production; others again go so far as to partake of net-caught fish. The advantages urged for vegetarianism are: the avoidance of the taking of life, the greater freedom of fruit and vegetables from germs of disease, economy, and the beneficial effect of the regimen alike on physical health and moral character. The oldest British vegetarian society is that of Manchester; while among the most flourishing at present is the 'fruitarian' Order of the Golden Age (headquarters, Paignton, Devon), which publishes much literature on the subject. The imposition of 'meatless days' in the European War, and the subsequent high prices of flesh foods, have given considerable impetus to informal vegetarianism; but the consensus of scientific opinion is that man, at least in a temperate climate, requires a proportion of flesh in his diet.—BIBLIOGRAPHY: Howard Williams, *The Ethics of Diet*; Anna Kingsford, *Perfect Way in Diet*.

Vein, in mining, a crack or fissure in a rock, filled up by substances different from the rock. Veins are sometimes many yards wide, having a length of many miles, and they ramify into innumerable smaller parts, often as slender as threads. Metallic veins are of very varied ages, but in the British Isles are mostly older than the Permian period.

Veins, a system of membranous canals or tubes distributed throughout the bodies of animals for the purpose of returning the impure blood to the heart and lungs, after it has been conveyed to the various parts by the arteries. They are not elastic and have no pulsation (thus differing from the arteries), the motion of the blood in them being mainly secured by pressure of the moving parts between which they are embedded, the backward flow of the blood being prevented where necessary by a series of valves which permit a current only towards the heart. The veins at their farthest extremities form capillaries which collect from the tissues the blood brought by the arterial capillaries. These minute branches unite to form veins, which similarly unite in turn, forming gradually larger branches and trunks as they approach the heart. The venous blood from the head, neck, and upper limbs is all returned to the heart by one great vein, the *vena cava superior*, while that from the lower limbs and belly is returned by the *vena cava inferior*. The portal vein (*vena portæ*) receives the venous blood from the intestines and conveys it through the liver to the vena cava inferior. From each lung to the heart come two pulmonary veins carrying back the blood that has been purified in the lungs, after being carried to them by the pulmonary artery. See *Heart*.

Velasquez (ve-las'keth), or, in full, Don Diego Rodriguez da Silva y Velasquez (or Velazquez), Spanish painter, was born at Seville in 1599, died at Madrid in 1660. He studied first under Francisco Herrera the elder, and afterwards under Francisco Pacheco, but early came under the influence of the Naturalist school inspired by Caravaggio. His earliest work, consisting mainly of the so-called *bodegones* (eating-house) pieces, pictures of still life with figures, show the realism and desire to reproduce the visual aspect of things which inspired him all his life. In 1622 he visited Madrid, and in 1623 was appointed painter to Philip IV, beginning the famous series of portraits of that king, of which two fine examples are in the National Gallery. Thenceforward Velasquez combined realism with increasing dignity and reticence of treatment, the qualities which give his work its distinctive character. In 1628 Rubens's visit to Madrid not only directly influenced Velasquez but led to his visiting Italy in 1629, where he especially studied Titian. Tintoretto, and Michelangelo, and formed a friendship with Ribera. In 1631 he returned to Spain. Among his paintings of the next few years are the equestrian portraits of Philip IV and of Olivares, portraits of the queen and of Don Balthasar Carlos, the *Lady with a Fan* (Wallace Collection), *Venus Recumbent* (National Gallery), and the famous *Surrender of Breda* (Prado, Madrid). In 1649 he again visited Italy, primarily to collect pictures for the king; and while in Rome painted the brilliant portrait of Innocent X in the Doria Pamphili Palace, Rome. To the years after his return in 1652 belong such masterpieces as *Las Hilanderas* (The Tapestry Weavers), *Las Meniñas* (The Maids of Honour), and the portraits of Philip IV when old. Velasquez's influence, especially during the nineteenth century, has been immense. His later work paves the way for that of Manet and the Impressionists, in its use of light and shade to obtain a series of silhouetted forms from which his design is composed; in his feeling for tone, which enables him to fill his canvases with light and air; in his distribution of accent, so that the more important parts of his picture are emphasized and seen first; and in his use of cool and warm neutral colours as a foil to touches of positive colour. Velasquez can be well seen in all his phases in England; but his powers can only be fully appreciated in Madrid.—BIBLIOGRAPHY: Sir W. Armstrong, *The Life of Velasquez*; R. A. M. Stevenson, *Velasquez*; A. de Beruete, *Velasquez.*

Velbert, a town of Westphalia, Germany, in the Ruhr; served by rail to Aprath, and the centre of an electric railway to Elberfeld, Werden, and Hösel. Brandy, machinery, cutlery, silk, &c., are manufactured. Pop. 20,000.

Velella, a curious genus of colonial cœlenterate animals, of the class Hydrozoa, order Siphonophora (q.v.), and represented by free-swimming oceanic forms, which occur around the British coasts, but more frequently in warm seas. The best-known member, *Velella spirans*, or 'Sallee Man', is about 2 inches in length by 1½ inches in height. It is of a beautiful blue colour and semi-transparent, and floats on the surface of the sea with its vertical crest exposed to the wind as a sail.

Velez, an ancient city of Colombia, South America, in the department of Santander. Pop. 15,000.

Vel'ez-Mal'aga, an ancient city of Spain, in the province of Malaga, on the Velez. The district produces sugar-cane, the olive, the vine, sweet-potato, maize, &c. Its port is the suburb Torre del Mar, a summer bathing-place with a sugar-refinery. Pop. 24,140.

Velez Rubio, a town of Spain, in the province of Almeria, in the valley of the Rio de Velez. At Fuente del Gato near by there are mineral springs. Pop. 11,000.

Veli'no, a river of Central Italy, a left-bank tributary of the Nera, at its junction with which it forms the falls of the Marble Cascade, about 650 feet high.

Velletri (ancient Velitræ), a city of Italy, in the province of Rome. Pop. 20,000.

Vellore, a town of Madras, India, on the Palar River. Pop. 46,000.

Velvet, a rich silk stuff, covered on the outside with an exceedingly large number of erect yarns, that is, short lengths which stand from the foundation of the cloth like stubble from the ground. In this fabric part of the warp is passed over wires so as to make a row of loops which project as indicated, the cut ends being obtained by a knife edge on the end of the wire, which severs the row of loops as it is being withdrawn. These fabrics are made in Great Britain, America, France, and Germany, as well as in other countries. Genoa cords, velveteens, corduroys, and similar fabrics have their short tufts or pile formed from the weft yarns. No wires are required for the latter fabrics, nor for warp pile velvets made on the double-plush weaving principle, but several wires are used in each loom for the single variety. In turn, each wire farthest from the reed is inserted into the pile shed either by hand or by mechanical means. Pile fabrics, such as Axminster carpets, are made without the use of wires, nor are Jacquard machines required for their production.

Vendace, some of the salmonoid fishes of the genus Coregŏnus. There are two British species —*C. vandesius*, inhabiting the Castle and Mill Lochs, Lochmaben (Dumfriesshire); and *C. gracilior*, native to Derwentwater and Bassenthwaite. The average length is about 6 to 7 inches. The upper parts are of a greenish-brown colour, the under parts silvery. The fish is esteemed a great delicacy, and is taken with the sweep-net about August. The species of Coregŏnus are collectively known as 'white-fish'. See *Gwyniad*; *Pollan*; *Powan*.

Vendée (vȧṇ-dā), a western maritime department of France; area, 2690 sq. miles. It is watered in the north by tributaries of the Loire, and in the south by the Vendée, Lay, and tributaries of the Charente. The principal crops are grain, potatoes, beet, and hemp; and a white wine is also produced. Capital, La Roche-sur-Yon. At the time of the Revolution the Vendéans espoused the Royalist cause, and, inspirited by La Rochejaquelein, Cathelineau, and other leaders, and aided by the hilly and wooded nature of the ground, they resisted the Republicans with varied success from 1793 to 1796, when the rising was completely quelled by the activity of General Hoche. In 1799–1800, and again in 1814 and 1815, some risings took place in favour of the Bourbons, but they were quickly suppressed. Pop. (1921), 397,292.

Vendet'ta (Italian word from Lat. *vindicta*, revenge), a blood-feud; the practice of the nearest of kin executing vengeance on the murderer of a relative. In Corsica the vendetta is regarded as a duty incumbent on the relatives of the murdered man, and, failing to reach the real murderer, they take vengeance on his relatives. The practice exists, although to a more limited extent, in Sicily, Sardinia, and Calabria, as well as among the Druses, Circassians, and Arabs.

Vendôme (vȧṇ-dōm), a town of France, in the department of Loir-et-Cher, on the Loir. It was captured by the Prussians in the Franco-Prussian War (16th Dec., 1870). Pop. 9800.

Vendor. A vendor is one who sells goods or property, or on whose behalf such are sold. The party who buys the same, or on whose behalf the same are bought, is called the vendee or purchaser. In the sale of goods the terms more frequently used are seller and buyer. The obligation on a vendor is to deliver the subjects or a good title thereto in exchange for the price. He warrants his right to sell. A vendor of real property must, unless otherwise agreed, produce to the purchaser a forty years' title to the subjects. If he die before receiving payment of the price, the contract does not lapse—the purchase money passes to his executors as part of his personal estate.

Vendor's shares are fully paid-up shares in a company taken by the seller of property to the company in payment or part-payment of the purchase price. They may rank *pari passu* with the shares issued by the company for cash, or they may have rights postponed to those of the other shares, and may be entitled to a large participation in any surplus profits after the other shares have received a specified dividend.

Veneer, a thin layer of choice hard wood, such as mahogany, rosewood, maple, &c., glued to the surface of wood of a commoner sort, such as fir or pine, so as to give the whole the appearance of being made of the more valuable material. It is mostly used for furniture, and owing to modern improvements in sawing machinery, layers as thin as paper can be obtained.

Venetia, a *compartimento* of North Italy, divided into the provinces of Belluno, Padua, Rovigo, Treviso, Udine, Venetia, Verona, and Vicenza. Area, 9408 sq. miles; pop. 3,960,000. Physically it comprises a large plain with lagoon-fringed shores on the Adriatic, and merging in the Hinterland with spurs and foot-hills of the Alps, by which it is flanked. The chief rivers are the Po, Mincio, Adige, Brenta, Piave, and Tagliamento, the two first marking the boundary in parts, as does also the Lake of Garda. Rice is produced in Rovigo, and the raising of cereals, viticulture, and sericulture are general. Manufactures reach their highest development in the provinces of Venetia and Vicenza. Venice is the capital.

Venetia, a maritime province of Venetia, North Italy. Area, 944 sq. miles; pop. 514,000.

Venetian Architecture, or **Venetian Gothic**, that style of Italian architecture employed by the Venetian architects from the fifteenth to the early part of the seventeenth century. The principal characteristics are: each story is provided with its own tier of columns or pilasters, with their entablature, and separated from the other stories by conspicuous friezes or belts, often in the form of balustrades broken by pedestals and ornamented by figures; arched windows ornamented with columns, the spandrils being often filled with figures; ornamental parapets are common; and the whole has a rich and varied effect. This style of architecture is characterized by Fergusson as "Gothic treated with an Eastern feeling, and enriched with many details borrowed from Eastern styles".

Venezuela (*Estados Unidos de Venezuela*), a Federal Republic of South America, comprising twenty states, two territories, and the Federal district of Caracas, the whole having an area of approximately 398,594 sq. miles.[1]

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[1] This figure is quoted from H. D. Beaumont (*Report on Economic, &c., Conditions in Venezuela*, 1921: H.M. Stationery Office), and is given also in *The Statesman's Year Book* (1923). Another estimate, for which no authority is obtainable, is 363,728 sq. miles. The *Venezuelan Year Book* (1906) gives the area as 599,538 sq. miles, A. and L. Heilprin as "about 450,000 sq. miles", and Chisholm as 593,943 sq. miles. The Venezuelan census of 1920 provides another puzzle by showing the total population to be 2,411,952.

Physical.—There are roughly four physical divisions. The Sierra Pacaraima, which forms the frontier with Brazilian Guiana, and the Sierra Parima compose, in the main, the physical division known as the Guiana Highlands. These Highlands drain northwards to the Orinoco, and in the south to the Amazon. Roraima (8600 feet; see *Guiana*) is the chief feature of the Sierra Pacaraima, and forms the point of convergence of the Venezuela-Brazil-British Guiana frontier. The Venezuelan Andes form the second division, the main block of which is the Sierra Nevada de Mérida, formed by the bifurcation of the Cordillera Oriental of Colombia. Trending in a north-easterly direction, the Sierra Nevada or Cordillera de Mérida separates the Orinoco basin from that of the Gran Lago de Maracaibo and the basin of the Tocuyo and other coastal streams, and, swinging eastwards from the Rio Cojeres as the Maritime Andes, forms a self-contained double range of mountains which reach almost to the Atlantic at the Gulf of Paria. The enclosed valley between the parallel ranges is renowned for its fertility, and forms the very heart of Venezuela. Two chief divisions of the Maritime Andes are the Cordillera de la Silla (behind Caracas; 8500 feet) and the Heights of Cumana (farthest east). The third great physical division comprises the *llanos*, vast alluvial peneplanes traversed by anastomosing rivers, and confined mainly to the region bounded by the Sierra Nevada in the west, the Orinoco in the east, and the Apure in the north. A transmontane division, embracing chiefly the department of Zulia, comprises a low-lying zone encircling the Maracaibo Lagoon, and bounded on the west by the western fork of the Cordillera Oriental of Colombia. Maracaibo Lagoon is being slowly silted up. The great hydrographic feature is, of course, the Orinoco, to the basin of which the greater part of Venezuela belongs. Venezuelan tributaries are the Caroni and Ventuari, which traverse the Guiana Highlands, and the Apure (with Guarica and Portuguesa), Arauca, Meta, and Caura (see *Cassiquari*). Climatically, Venezuela has several zones. On the coast the north-east trade winds blow all the year round, but are weakest in July, the rainy season. April and May are the warmest months; December and January the coolest. Up to 3000 feet altitude the temperature may be represented by La Guaira, which has a mean of 80·8° F. for the year (January, 78·4° F.; September, 82·9° F.: range, 4·5°). From 3000 to 6500 feet altitude is what is known as the 'Temperate Zone', and may be represented by Caracas (3020 feet), where the mean annual temperature is 71·2° F. (January, 68·5°; May, 73·9°: range, 5·4°). At Caracas the rainfall is 31·9 inches for the year, and June, July, and October are the wettest months. In the *llanos* May to October is the wet season, and in the Mountain Zone (above 13,000 feet) the rainfall is equally distributed over the whole year. Between 6° and 8° lat. on the Sierra Merida, the snow-line is reached at 15,000 feet. On the coastal flats and in the Orinoco delta and riverine zones the climate is very unhealthy.

Production.—The chief industries are cattle-raising and the production of coffee, cacao, and sugar. About 20 per cent of the population is agrarian. Maize is the staple grain-crop, and some cotton, tobacco, and tropical fruits are raised. In the forestal zone balatá (a notable export), rubber, copaiba, chicle (raw chewing-gum), vanilla, tonka beans, and valuable timbers are produced. Venezuela is one of the world's greatest coffee exporters, and coffee and cocoa are the chief exports (see *Puerto-Cabello*). Mineral resources and products are rich and extensive. Saline thermal springs, about the hottest in the world (196°–206° F.) exist at Las Trincheras on the Puerto-Cabello-Valencia Railway. Coal is worked in the State mines at Naricual, and gold (originally from the Yurari district), copper ore (low grade), salt (a Government monopoly), petroleum (refined at San Lorenzo on Lago Maracaibo), asphalt (from Lake of Guanoco; exported to United States through the port of Cristobal Colón), and pearls (see *Margarita*) are among other products. Manufactures, which are undeveloped and relatively unimportant, include cotton (the chief), cement, matches (a Government monopoly), glass, coarse paper, beer, cigars (at Caracas), leather (Caracas, Maracaibo, and Ciudad Bolivar), candles (Caracas and Maracaibo), rope, tiles (Caracas), and butter and cheese (in one factory at Maracay).

Railways.[1] — *La Guaira - Caracas (3 feet), Caracas-Valencia (3 feet 6 inches), *Tucacas-

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In 1891 the census showed a total of 2,323,527 souls, and as there appears no reason why the intercensal increase in population should be so small, it is considered that an addition of 5 per cent, or more, to the 1920 census figures is necessary to arrive at an estimate that will be approximately correct. There are upwards of 70 islands off the coast, with a total area of about 15,000 sq. miles. The departments, with their pops. (1920 census) and capitals in parentheses, are: Anzoátegui (103,500; Barcelona), Apure (39,190; San Fernando), Aragua (95,900; Maracay), Bolivar (65,850; Ciudad Bolivar), Carabobo (125,520; Valencia), Cojedes (81,850; San Carlos), Falcon (128,255; Coro), Guarico (122,190; Calabozo), Lara (219,820; Barquisimeto), Mérida (123,230; Mérida), Miranda (174,270; Ocumare), Monagas (64,420; Maturin), Nueva Esparta (56,035; La Asuncion), Portuguesa (52,550; Guanare), Sucre (150,210; Cumana), Tachira (147,080; San Cristobal), Trujillo (178,950; Trujillo), Yaracuy (108,000; San Felipe), Zamora (55,050; Barinas), Zulia (119,460; Maracaibo); territories—Amazonas (48,940; San Fernando de Atabapo) and Delta Amacuro (13,474; Tucupita); and the Federal District — Caracas (140,132). Ports include Puerto-Cabello (q.v.), the chief port of Carabobo (q.v.); La Guaira (see *Caracas*); Carúpano; and Maracaibo (q.v.). See *Mérida*; *Nueva Esparta*; *Margarita*; *Portuguesa*; *Apure*; *Trujillo*; *Zulia*; *Zamora*.

[1] The gauge is given in brackets. The asterisk (*) indicates a British-owned line. All the others are Venezuelan excepting the second, which is German.

Barquisimeto system (2 feet), Encontrados-Táchira (3 feet 6 inches), La Ceiba-Motatan (3 feet), *Caracas-San Francisco de Yaré (3 feet 6 inches), Carnero-La Española del Guapo (3 feet), Guanta-Barcelona and Naricual Mines (3 feet 6 inches), Santa Barbara-El Vigia (metre), Coro-La Vela (3 feet), *Valencia-Puerto-Cabello (3 feet 6 inches).

Social, &c.—The State religion is Roman Catholicism, but absolute freedom is allowed. An archbishop (of Caracas), with five bishops suffragan, controls the State ecclesiastical organization. Free, compulsory education, from the age of seven years to the date of completion of the elementary course, is provided, and there are universities at Caracas and Mérida (University of Los Andes). Conscription for two years is enforced upon all Venezuelans, and the reserve period covers all able-bodied men up to the age of forty-five years. There is a small naval force of three gunboats and a training-ship.

Government.—Venezuela is a Federal Republic. The component states are supposed to be autonomous, and are nominally governed by Presidents, each of whom has a Secretary, and a Legislative Assembly. Territories (the Federal District also) are governed directly by the President, through his Governors. Caracas is the seat of the central power, consisting in a President and a bicameral Congress, whose houses are called Senate (40 members) and Chamber respectively. Congress chooses the President, who takes office for seven years and may be re-elected. Venezuela is a modern state formed in 1830 by secession from the Republic of Colombia. —BIBLIOGRAPHY: *Venezuela* (a general treatise on the laws, geography, &c., of the Republic, issued at Washington (1904) by the Bureau of American Republics); *Central and South America* (in Stanford's *Compendium of Geography and Travel*), vol. i, *South America* (by A. H. Keane); W. E. Wood, *Venezuela: Two Years on the Spanish Main*; P. F. Martin, *Through Five Republics of South America* (an historical, geographical, economic, and political summary).

Ven'ice (It. *Venezia*), a city and seaport of Northern Italy, capital of the province of Venezia, on a number of islets in a shallow lagoon in the north-west arm of the Adriatic (i.e. the Gulf of Venice); served by rail via Padua to Bologna (100 miles) and Milan (165 miles), via Udine to Tarvisio (148 miles), and to Trieste via Nabresina (99 miles). A long railway viaduct (the Ponte Sulla Laguna) connects the mainland with the main station of Venice (the *Stazione della Strada Ferrata*) and the adjacent *Stazione Marittima*. The islets are very low, and the houses are mostly supported on piles. The city is divided into two parts by the Canalazzo or Grand Canal, spanned by the Rialto and lesser bridges. The numerous branch canals are crossed by over 300 bridges, which rise rapidly towards the centre to afford passage to the gondolas and other boats. The city is also intersected by *calli* or narrow lanes for pedestrians; but the canals are really the streets of Venice, and it possesses neither horses nor wheeled carriages. Near the centre of the city there is one street about 18 feet wide, the Merceria, but the great centre of business and amusement is the Piazza, or Square of St. Mark, and the piazetta adjoining it, which faces the Canale di San Marco. The Palace of the Doges, reconstructed by Marino Falieri in 1354, abuts on the piazetta. It contains a number of beautiful halls, some with ceilings and walls painted by Tintoretto, Paolo Veronese, and other masters. The Ponte-dei-Sospiri (Bridge of Sighs) connects the palace with the public prisons on the opposite side of a narrow canal. The church of St. Mark (S. Marco), now the cathedral (erected 976–1071), is in the Romanesque-Byzantine style, and is surmounted by five domes. Above the doorway are the four bronze horses brought from Constantinople by the Doge Dandolo in 1204. Other notable churches are Santa-Maria-Gloriosa-de'-Frari (thirteenth century), containing the tomb of Titian, and numerous works of art; and San Giovanni-e-Paolo, a splendid Gothic domed building. Of the numerous palaces among the chief are the Palazzo-Reale (royal palace and library); Palazzo-Ducale (the palace of the doges), with a library and many paintings; and the Palazzo-Corner-della-Cà-Grande, the seat of municipal authorities. The remaining public buildings include the Accademia delle Belli Arti, containing works by Titian, Giorgione, Tintoretto, Paolo Veronese, and others; the Dogano, or custom-house; the arsenal; and the Zecca, or mint. The chief manufactures are woollen cloth, cloth of gold and silver, velvet, lace, ornamental and coloured glass, mosaic, jewellery, and castings. The trade is extensive; the imports include colonial goods, dye-woods, coal, iron, and oil; exports, timber, rice, linen, glass, coral, &c. The harbour is spacious, but the entrances are shallow. Pop. 171,700.

Venice is supposed to have been founded in the fifth century by inhabitants of the surrounding districts, who took refuge from the cruelty of Attila on the islets at the mouth of the Brenta. In 697 Pauluccio Anafesto was elected the first doge or duke, and in 819 the seat of government was removed from Malamocco to Rivoalto (Rialto), and the adjacent islands were connected by bridges. The Crusades (1096 to 1271) greatly increased the wealth and power of the Venetians by giving employment to their shipping. In 1204 the Doge Enrico Dandolo conquered Constantinople, and upon the division of the Byzantine Empire Venice received a large accession of territory. Under Dandolo's successors the Venetians gradually lost all their mainland possessions. But in 1386 they captured Corfu, Durazzo, Argos, &c.; in 1405 their general, Malatesta, conquered Vicenza, Belluni, Verona, and Padua; and besides these and other conquests on land, the Venetian fleet defeated the Turkish at Gallipoli in 1416, and in 1421 subjugated all the towns along the Dalmatian coast. At the close of the fifteenth century Venice had a population of 200,000, and was the centre of the entire commerce of Europe. Its power then began to decline, its commerce was gradually superseded by that of the Portuguese, and in 1508 a league to subdue the republic was formed at Cambrai between Pope Julius II, the Emperor of Germany, and the kings of France and Spain. All its possessions on the mainland were taken, and the work of destruction was all but completed by warfare with the Turks at intervals from 1649 to 1718. The French took possession of the city in 1797. It subsequently became part of the Austrian Empire, of Napoleon's kingdom of Italy, and from 1815 to 1866 of the Lombardo-Venetian Kingdom under Austria. In 1866 the city and province was ceded to Napoleon III, under whose auspices they were united by a plebiscite to the Kingdom of Italy.

Venizelos, Eleutherios, Greek statesman, born 1864. A Cretan barrister, he was a leader of the insurrection that released Crete from the Turkish yoke (1897), and was elected for Athens to the Greek Assembly (1910). From 1910 to 1920 he was the dominant figure in Greek politics. He founded the Balkan League (1912), and in 1914 (European War) was pro-Entente; but his proposals for war, though supported by the electorate, were vetoed by King Constantine. In 1916 he founded a revolutionary Provisional Government in Crete, and on the dethronement of Constantine by Britain and the succession of Alexander, Venizelos returned to Athens (1917), reorganized the Government, and declared war against the Central Powers. He represented Greece at the Peace Conference, but was somewhat ungratefully rejected at the elections of Nov., 1920.

Venlo, a town of the Netherlands, in the province of Limburg, on the Meuse. It has manufactures of needles and cigars. Pop. 20,000.

Veno'sa (ancient **Venusia**), a city of Italy, province of Potenza. It has a cathedral (with tomb of Robert Guiscard), and a castle dating from the fifteenth century. Horace was born here in 65 B.C. Pop. 9000.

Ventilation. During recent years ideas upon ventilation have undergone some change. At one period the condition of air as regards its purity was judged solely with reference to the amount of its contained carbonic acid gas. This purely chemical standard has to a great extent been discarded, as it is found that other factors, such as the temperature and motion of the air, and the percentage of moisture present, are important. Ventilation is effected by both natural and mechanical agencies, but in any system of ventilation both air inlets and air outlets are essential. Natural ventilation is mainly dependent upon the wind, the difference in temperature of the internal and external air, and the diffusion of gases. Windows make excellent air inlets, and draughts may be avoided by the use of deflecting hoppers or screens. A chimney in a room makes a very good air outlet. Gratings in walls also serve as air outlets, and are specially useful when placed opposite air inlets, so that cross ventilation is obtained. Various forms of roof ventilators are also used as outlets for vitiated air. In mechanical systems of ventilation the movement of the air is effected by fans. There are three distinct types: first, those in which extracting fans are employed, the air been *drawn* into, and through the apartments; second, those in which the air is *forced* through the rooms; third, those systems in which both extracting and forcing fans are used. The first system is suitable for the direct removal of fumes and dust; the second system is useful where it is desirable to purify the inlet air. In the third or combined system the ventilation is not deranged by the opening of doors or windows.

Ventimiglia, a town of Italy, in the province of Porto Maurizio and in the Riviera di Ponente; served by the coastal railway (Marseilles-Genoa) and to Cuneo (see *Porto Maurizio*). Pop. 8000 (commune, 13,000).

Ventnor, a watering-place of England, on the south-east shore of the Isle of Wight, in the district of Undercliff. It has a hospital for consumptives, and a seaside home. There is a good beach for bathing. Pop. (1921), 6100.

Ventose (literally, 'windy month'), the sixth month of the French Revolutionary Calendar, beginning on 19th Feb., and ending on 20th March.

Ventril'oquism, the art of appearing to produce vocal sounds from some source other than the speaker's lips. The word is derived from *venter*, owing to the mistaken belief of the Romans that the belly was the seat of such production. The illusion is effected by permitting only a slow escape of the breath; by narrowing the glottis, opening the mouth but slightly, and moving only the tip of the tongue; also by engaging the attention of the audience to by-play, facial expression, and, usually, a marionette with movable lips. The practice is of wide distribution, ranging from India and China to the African Zulus and the Eskimos of the North. It was known to the Egyptians, Hebrews, and Greeks; and it is highly probable that the supposed miraculous utterances emitted by the oracles of Greece, with other wonders of like nature, were produced by means of ventriloquism by the priests and skilled practitioners.

Ve'nus, the Roman name of the goddess of love, called by the Greeks Aphroditē. In the *Iliad* she is described as the daughter of Zeus and Diōnē; but Hesiod represents her as the offspring of Urănus, born among the foam (Gr. *aphros*) of the sea. She surpassed all other goddesses in beauty, and hence received the apple which was to be awarded to the most beautiful by Paris. She was the wife of Hephæstos (Vulcan), but also bestowed her love on the gods Arēs (Mars), Dionysos (Bacchus), Hermes (Mercury), and Poseidon (Neptune), and the mortals Anchises and Adonis. The myrtle, rose, poppy, apple, and other fruits were sacred to her, as were also the dove, sparrow, swan, swallow, ram, hare, and tortoise. The chief places of her worship in Greece were the Islands of Cyprus and Cythera. In Rome several temples were erected to her under different names. In the best days of art this goddess was always represented draped, in later times nude. The scene of her arising from the sea was sculptured by Phidias on the base of the statue of Zeus at Olympia, and one of the most famous pictures of Apelles represented the same subject. The Venus of Capua and the Venus of Milo represent her as Venus Victrix, with one foot on a helmet and raising a shield. The Venus de' Medici is supposed to be a free copy of a statue of her by Praxiteles, which was celebrated above all her other statues in ancient times. Among modern statues of Venus, one of the most famous is that by Canova, which represents her as issuing from the bath.—Cf. L. R. Farnell, *The Cults of the Greek States*.

Venus, one of the inferior planets, having her orbit between those of Mercury and the earth (see *Planet*). Her diameter is 7600 miles, and her volume about 0·88 of the earth's, but her density being slightly less her mass is equal to about 0·83 of the earth's. Venus is the most brilliant of all the planetary bodies. When west of the sun she is seen as morning star, when east as evening star. Hence she gained the designations of *Lucifer* and *Hesperus*, and some ancient peoples believed the appearances to be really of different objects. According to her various positions relatively to the sun and earth, she exhibits phases like the moon. Though a beautiful object in the telescope, the dazzling brightness of the disc of Venus, probably due to the high reflective power of a cloudy atmosphere, renders it difficult to discern clearly any surface detail. It was long supposed that the planet rotated in about 28½ hours. Some astronomers now think that the period is 225 days, identical with that of revolution. See *Transit*.

Vera Cruz, a maritime state of Mexico; area, 27,880 sq. miles; pop. 1,125,500 (after Jalisco, the state with the largest population in Mexico). Physically considered, it rises from a lagoon-fringed, alluvial, coastal zone, through the submontane region of the Sierra Madre Oriental, to merge in the Mexican Plateau, and includes within its boundaries the peak of Orizaba (18,800 feet). In the south of the state, on the coast, is the volcano of Tuxtla (4920 feet). The climate varies from the heat, and unhealthy humidity, of the coastal steppe, through every gradation to the cold dryness of the everlasting snows on Orizaba and the Cofre de Perote (13,400 feet). Sugar and rum are the chief products, with coffee not far behind; but many other important commodities are raised, such as cotton, vanilla, maize, and various fruits. Cattle and horses are bred here and there, and there is a large forestal industry, and some mining activity. Jalapa is the capital; other towns are Vera Cruz*, Tuxpan*, Puerto Mexico (or Coatzacoalcos)*, Nautla*, Alvarado*, Orizaba, and Cordobas. The asterisk indicates a port.

Vera Cruz, a city and the chief seaport of Mexico, in the state of Vera Cruz; served by four railways (two to Mexico City). There is a large foundry, and tobacco is manufactured. Pop. 48,700.

Founded by Cortes in 1520, the city was removed in 1599 to its present site on the low coastal flats, and has since been sacked by privateers (1653 and 1712), captured by the French (1838), by United States troops (1847), again by the French (1861), who made it their head-quarters during the campaign of 1862–7, and in 1914 by the United States. The fort of San Juan de Ulloa, first built after the privateers had raided the city, is the key to the place. It occupies one of the coralline reefs that protect the harbour, and its fall has always left Vera Cruz at the mercy of the victor.

Verat'rin, or **Verat'ria**. See *Veratrum*.

Verat'rum, a well-known genus of plants belonging to the nat. ord. Liliaceæ. *Veratrum album* (common white hellebore) is a native of most alpine meadows in the southern, central, and northern parts of Europe. It has large plaited leaves, erect stems, and large panicles of greenish flowers. It yields the substance veratrin, used as an external application in cases of neuralgia.

Verbe'na, a genus of plants, the type of the nat. ord. Verbenaceæ. Most of the species are American; about seventy are enumerated. *V. officinālis* (common vervain), a plant common in England, and widely distributed, was once held in great repute for its medicinal virtues.

Several species are cultivated for the great beauty of their flowers, being fine border plants. The verbena of the perfumers is the lemon-grass, from which the 'oil of verbena' is extracted.

Verbena'ceæ, a natural order of plants, consisting of trees, shrubs, and herbaceous plants common in the tropics of both hemispheres, but rare in Europe, Asia, and North America. They have generally opposite or whorled simple or compound leaves without stipules; flowers in opposite corymbs, or spiked alternately, sometimes in dense heads, seldom axillary or solitary. The verbena and teak are examples.

Vercelli (ver-chel'lē), a town of Piedmont, North Italy, province of Novara, on the Sesia. It has a seventeenth-century cathedral, a castle, now converted into courts of justice; hospital, cavalry barracks, &c., flourishing manufactures and trade. The Gothic church of Sant' Andrea dates from 1219. In 101 B.C. Marius defeated the Cimbri at Vercelli. Pop. 31,900.

Verd-antique, in mineralogy, an aggregate of serpentine and white marble, having a general greenish colour. It is beautifully mottled, takes a fine polish, and is much used for ornamental purposes. *Oriental Verd-antique* is a green porphyry used as an ornamental stone.

Verden, a town of Hanover, Prussia, on the Aller, near its confluence with the Weser; served by the railway Bremerhaven-Wunstorf (via Eystrup). It has breweries, distilleries, and manufactures of cigars. Pop. 10,060.

Verdi, Giuseppe, the greatest Italian opera composer of the nineteenth century, was born at Roncole, near Busseto, Parma, on 10th Oct., 1813, died 1901. At the age of seven he became a pupil of the local organist, and three years later succeeded his master as organist. He was sent to school for two years at Busseto, at that time a musical centre, and Barezzi, the president and patron of the local philharmonic society, and Provesi, the conductor, were greatly interested in Verdi. When sixteen he was sent to Milan, where he studied under Lavigna. In 1833 he went back to Busseto, but returned to Milan in 1838, when the opera *Oberto* was produced at La Scala with considerable success. The opera *Nabucco* was produced in 1842, and between then and 1871 Verdi produced twenty-three operas, not all of which were successful. Among his most popular works are: *Rigoletto* (1851), *Il Trovatore* and *La Traviata* (1853), *Un Ballo in Maschera* (1859), *La Forza del Destino* (1862), and *Aida* (1871). *Otello* (1887) and *Falstaff* (1893), a remarkable piece of work for a man of eighty, are among his greatest works. Of non-operatic music, his *Requiem* is the only classic.

Ver'digris, a poisonous substance, prepared by exposing copper to the air in contact with acetic acid, and used as a pigment, as a mordant, and in medicine. The name is also popularly given to copper rust, the green or bluish substance formed by the action of carbon dioxide on copper in the presence of water; this is a basic carbonate, of the same composition as malachite.

Verdun (ancient **Verodonum**), a town of France, on the Meuse, forming a first-class fortress and railway node; a junction on the lines Châlons-Conflans and Lerouville-Sedan, for the branch line Verdun-Bar-le-Duc. It is famous for its manufactures of *dragées* (sugar-plums) and preserves, but has tanning, flour-milling, brewing, and other industries, as well as a large trade in cereals, wood, wine, &c. During the European War Verdun figured prominently as the core of French resistance (see *European War*, sections *1916 on the European Fronts* and *French Front in the West, 1917*). Pop. 20,000.—There are two other French towns of note: *Verdun*, in Tarn-et-Garonne: pop. 3500; and *Verdun* (*Sur-le-Doubs*), ancient *Verodunum Castrum*, in Saône-et-Loire, at the confluence of the Saône and Doubs; served by the Chagny-Dôle branch of the P. L. M. Railway, via Allerey; pop. 2000.

Verhaeren, Émile, Belgian poet, born in 1855, killed when attempting to enter a moving train at Rouen in 1916. Educated at Ghent and at Louvain, he founded *La Semaine* and became the leader of the literary group known as Young Belgium (*La Jeune Belgique*). Verhaeren was an impressionist, and his poetry is distinguished by vividness, imagery, and dramatic intensity. His works include: *Les Flamandes* (1883), *Les Moines* (1886), *Les Soirs* (1887), *Au bord de la route* (1890), *Les Villages illusoires* (1894), *Les Visages de la vie* (1894), *Les Forces tumultueuses* (1902), and the series *Toute la Flandre* (1904–11). In 1914 appeared his *Belgique Sanglante*, dealing with the German invasion of his native country.

Verkhoyansk, a town of Siberia, in the government of Yakutsk. It has the doubtful distinction of being the coldest place in the world, and the place with the greatest range of temperature on earth—over 100°. The mean temperature in January is −59° F.; but the average lowest temperature of that month is −83°, and −90°, the lowest reading ever taken on the surface of the earth, was recorded in Verkhoyansk in Feb., 1892. The highest January temperature ever recorded in Verkhoyansk was −18° F. In July the mean is 60°, and the absolute maximum 90° F. The rainfall is exceedingly small, only 3·9 inches for the year, according to Kendrew.

Verlaine, Paul, French poet of the Symbolist school, belonging to those known as the Decadents, born 1844, died 1896. Inspired by Baudelaire, he published in 1865 his *Poèmes Saturniens*, which were followed in 1869 by *Les*

Fêtes galantes. In 1870 he went into exile, and returned an admirer of Catholicism, to which mystic tendencies had led him. This new spirit is reflected in his work *Sagesse* (1881). He visited England and finally settled in Paris, where he passed the remaining years of his disorderly life, drinking absinthe and sojourning frequently in prisons and hospitals. Among his works are: *Romances sans paroles* (1887), *Parallèlement* (1889), *Bonheur* (1891), *Mes hôpitaux* (1891), *Confessions* (1895), and *Chair*. A master of verse, Verlaine invented new forms in French poetry, and his verse is lyrical, fluid, and magical. It is, however, somewhat of an exaggeration to compare him to Shelley, as A. Symons (*Colour Studies in Paris*) has done.—Cf. E. Lepelletier, *Paul Verlaine: sa vie, son œuvre*.

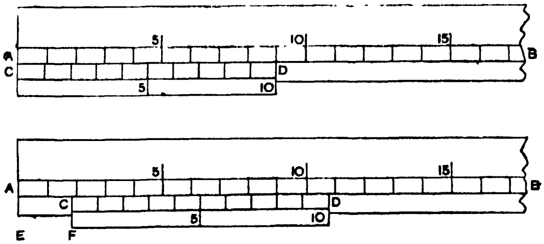
Vermejo (ver-mā'hō), or **Rio Grande**, a river of Argentina, rises in the highlands of Bolivia, and flows in a south-easterly direction to join the Paraguay; length, 1000 miles.

Vermont, an inland state in the New England division of the United States, deriving its name from the Green Mountains (*Vert mont*), a chain traversing it almost centrally from north to south (Mount Mansfield, 4400 feet), and forming a watershed between the streams running eastwards to the Connecticut River (the boundary with New Hampshire) and those flowing in a westerly direction to either Lake Champlain (q.v.) or the Hudson River. The state forms part of the uplands of New England, and has an average height of 1000 feet; but it is considerably lower in the north-west, abutting Lake Champlain, and the only navigable streams (Missisquoi, Otter Creek, Lamoille, &c.) are found there. Otter Creek is of greatest economic importance. Elsewhere the rivers are more or less swift, and are harnessed for power to drive sawmills and run the machinery used in the making of wood-pulp. Montpelier is the state capital, but Burlington (q.v.), a port of entry on Lake Champlain, is the largest city and the commercial capital. Other cities are Rutland (15,000), Barre (10,000), and St. Albans (q.v.). There are over 1100 miles of railways in Vermont, the chief lines being the Boston & Maine, Central Vermont, and the Rutland Railway (New York Central system). About 18 per cent of the population is foreign born, Scots numbering 1900, English 2200, and Irish 2900 (approximately). Canadians (English) and French Canadians together make up 56 per cent of the foreign-born population. The Roman Catholic religion predominates, with Congregational second and Methodist third. Agriculture is the chief industry, and over 50 per cent of the population is rural. Hay is the chief crop, followed by cereals of all kinds, potatoes, and apples. There is a tendency towards intensive development of dairying and live-stock, and, at the moment, Vermont is a leading butter producer, with a first-class record in economical methods of production, &c. Manufactures include cotton, flour, and machinery. About half of the marble of the United States is produced in Vermont (chiefly at Pittsford, Proctor, and West Rutland). Education is compulsory between the ages of six and sixteen years, and there are three universities (Vermont, Norwich, Middlebury). Area, 9564 sq. miles (440 miles being water); pop. 352,500 (including 570 negroes).

Vermont became a state of the Union in 1791. There are 14 counties. The Legislature is bicameral, comprising a Senate (30 members) and a House of Representatives (248 members), 2 Senators and 2 Representatives being sent to Congress.—BIBLIOGRAPHY: E. D. Collins, *History of Vermont*; E. Conant, *Geography, History, and Civil Government of Vermont*.

Verne (vern), Jules, French author, born at Nantes 1828, died 1905. He studied law, but afterwards began writing short pieces for the stage. In 1863 he published *Five Weeks in a Balloon*, and the vein of the marvellous, tinged with a quasi-scientific realism, was henceforth worked by him with great success. His more popular works are: *Twenty Thousand Leagues under the Sea*, *From the Earth to the Moon*, *Round the World in Eighty Days*, and *A Journey to the Centre of the Earth*. Most of his works have been translated into English.

Vernier. The vernier, invented by Pierre Vernier in 1681, is an auxiliary scale used to subdivide the divisions of an ordinary scale. The small scale divisions are one-tenth greater or less than those of the main scale. In the figure AB represents the main scale, CD the vernier with each division nine-tenths of the length of a division on AB. The vernier is set to measure the distance EF, which is seen to be more than one division and less than two. Looking along the vernier scale, the division



Vernier

marked 8 is seen to be in line with a division on the scale, which means that the point F is eight-tenths of a division ahead of the scale division 1. Each vernier division being one-tenth less than a scale division, eight of them are eight-tenths less than the same number of scale divisions.

Vero'na, a city of Venetia, North Italy, capital of the province of Verona, on the Adige. There is a Roman amphitheatre, supposed to have been built about the second or third century A.D., the interior of which is nearly perfect; an imposing fourteenth-century cathedral in the Gothic style; and many other magnificent churches rich in art treasures. Other notable edifices are the Palazzo del Consiglio, adorned with statues of celebrated natives of the town; and the Gothic tombs of the Della Scala family (Scaligeri), who ruled Verona from 1262 to 1389. Modern public buildings include theatres, a museum, a library, hospitals, literary institutions, &c. The town has manufactures of silks, woollens, hats, &c., and a considerable trade. Verona was subject to the Romans in the second century B.C., and on the decline of the Roman Empire it was taken by the Goths, and became the capital of Theodoric's empire. In 774 it was captured by Charlemagne, and subsequently became an independent republic. Weary of the dissensions of its nobles, it voluntarily ceded itself to Venice, under which it remained from 1405 to 1797. It belonged to the Austrians until 1866, when it became Italian. Pop. (commune), 86,448.

Veronal, a trade name for *malo-urea*, ($C_8H_{12}N_2O_3$), a white, soluble, crystalline powder, useful as a hypnotic in nervous insomnia and in insomnia associated with disease of the heart.

Veronese (vā-ro-nā'ze), Paul, the name usually given to Paolo Cagliari, an Italian painter, born at Verona in 1528, died at Venice 1588. He studied at Verona under his uncle, Antonio Badile, and Brusasorci; visited Mantua to work for Cardinal Gonzaga in 1547; and in 1555 settled in Venice. Here his early work won him immediate success. In 1560 he was commissioned to decorate in fresco the Villa Barbaro at Maser; and in 1562 produced the great *Feast of Cana*, now in the Louvre. In 1564 he visited Rome, and on his return to Venice was engaged to decorate the Ducal Palace. The fire of 1577 destroyed much of his work; but he was commissioned to paint a new series, of which the *Battle of Lepanto* (Academy, Venice) is the best-known example. In 1573 he finished *The Feast in the House of Levi* (also in the Academy), the introduction into which of German soldiery, buffoons, and a parrot led to his trial before the Inquisition on a charge of irreligion. This in no way affected his reputation, and he was busily engaged until his death. This last period is represented by the admirable examples of his work in the National Gallery, including the *Feast of Darius* and four *Allegories.* Conventional and artificial, his work is nevertheless redeemed by his brilliant handling, decorative designs, and splendour of colour.

Veron'ica, Saint, a female saint who, according to legend, met our Saviour bending under the weight of the cross, and offered Him her veil to wipe the sweat from His brow, when the divine features were found miraculously impressed on the cloth. This veil was brought from Palestine to Rome, where it is still preserved by the canons of St. Peter's.

Verrall, Arthur Woollgar, English classical scholar, was born in 1851, and died in 1912. He was educated at Wellington and at Trinity College, Cambridge. He graduated as second classic in 1873, and was bracketed First Chancellor's Medallist with S. H. Butcher and T. E. Page, this being the only occasion on which three medals were awarded. Verrall was called to the Bar in 1877, and in the same year became a member of the staff of his college. He published a brilliant edition of the *Oresteia* of Æschylus; but his services to Euripides were even more notable, including editions of the *Medea* and the *Ion*, and discursive works such as *Euripides the Rationalist* and *Four Plays of Euripides.* The work of Verrall did much to rehabilitate Euripides after the attacks of Niebuhr, Schlegel, and Swinburne. Verrall had a great gift for distilling new ideas from old material which had been handled by countless predecessors. As a lecturer he was eloquent and persuasive; and though he was himself a ' pure scholar ' of the old school, his vigorous mind and his keen sense of humour brought a current of fresh air into lecture-rooms too long hermetically sealed by an out-worn Porsonian tradition. For fifteen years he heroically endured an illness which crippled him. Some sixteen months before his death he was appointed the first King Edward VII professor of English literature at Cambridge.—Cf. M. A. Bayfield, *Memoir* in Verrall's *Collected Literary Essays, Classical and Modern.*

Versailles, a town of France, capital of the department of Seine-et-Oise; served by trams to Saint Cyr-Maule, &c., by the main line to Bordeaux, by the Grande Ceinture Railway, by frequent services from Paris (St. Lazare, Montparnasse or Invalides), and from Mantes (via Plaisir Guignon). It is regarded as one of the handsomest towns in Europe, having been built under the auspices of the sovereigns of France, particularly Louis XIV, who made it the seat of his court, and erected the palace. This is a large and imposing building with an extensive park and gardens, fine fountains, &c. Louis Philippe converted the palace into a national museum, and it contains an immense collection of statues and paintings representing personages and events connected with the French monarchy from Clovis downwards. In Oct., 1870, the Germans established their head-quarters at Versailles; from March 1871 till 1879 it was the seat of the French Government; and on 28th June, 1919, there was completed and signed in the Galerie des Glaces of the famous palace (the same room in which William I was crowned German Emperor in 1871), the Treaty of Versailles which marked the conclusion of the European War. Pop. 60,500.

Versailles, Treaty of, by which the European War was brought formally to a close, was signed on 28th June, 1919. The Allied and Associated Powers included the British Empire, the United States, France, Italy, Japan, Belgium, Bolivia, Brazil, China, Cuba, Czecho-Slovakia, Ecuador, Greece, Guatemala, Haiti, Hedjaz, Honduras, Liberia, Nicaragua, Panama, Peru, Poland, Portugal, Roumania, Serbia-Croatia-Slavonia (Yugoslavia), Siam, and Uruguay. The European territories ceded by Germany comprised: Alsace-Lorraine, restored to France, that country also receiving the Saar Valley (q.v.); Eupen, Malmédy, and a part of Moresnet, ceded to Belgium; while Luxemburg was freed from German influence; Posen District, part of West Prussia, passed to Poland, that country also receiving a guarantee of access to Danzig, which became a free city; Czecho-Slovakia received a portion of Upper Silesia; while the possession of certain other territories was reserved for future decision by a plebiscite, and Memel passed under the control of the Conference of Ambassadors.[1] Germany was further deprived of the whole of her overseas possessions, these being ultimately apportioned as follows: German East Africa (now Tanganyika Territory) to Great Britain; Togoland and *Kamerun* to Britain and France; German South-West Africa to the Union of South Africa; German possessions in the Pacific, lying south of the equator, to Australia and New Zealand; those north of 'the line' to Japan; that country also receiving Shantung, which was subsequently restored to China.[2] In reparation to France and Belgium for economic damage caused by the war Germany was required to supply them with cattle, sheep, coal, merchant shipping, dyestuffs, and other chemical products; to reimburse Belgium for the amount borrowed from her Allies during the war until the signing of the Armistice of Nov., 1918, and to replace the destroyed merchant ships of the Allies. The value of these reparations was estimated at £800,000,000. Further financial compensation exacted from Germany, to be discharged by 1958, included the cost of the war to the Allies, together with pensions to the disabled and to the dependants of those killed; an estimated total of £17,720,000,000. By other clauses of the treaty Germany's military force was reduced to a total of 100,000 men; her naval strength to six battleships of the *Deutschland* type, six light cruisers, twelve destroyers, and twelve torpedo-boats. Article 198 deprived her of all military and naval air forces, dirigible balloons, aeroplanes, seaplanes, or flying-boats.

Verse, a measured and cadenced form of speech or composition, usually adopted in poetry. Grammarians have elaborately classified the varieties of verse, and analytically distinguished the possible divisions of words into bars of accented and unaccented syllables. (See *Rhythm.*) The term is also applied to a line of poetry consisting of a certain number of metrical feet disposed according to the rules of the species of poetry which the author intends to compose. Verses are of various kinds, as hexameter, pentameter, &c. *Blank verse* is verse in which the lines do not end in rhymes. (See *Blank Verse.*) *Heroic verse* is rhymed verse in which the lines consist of ten syllables, five of them being accented, and constituting five iambic feet. See *Alexandrine.*

Versecz, a town of Yugoslavia. It has silk-mills, and a large trade in silk and wine, the latter largely curtailed by the ravages of phylloxera. Pop. 28,760.

Vertebra'ta (Chordata), a phylum of the animal kingdom distinguished by the possession of (1) a central nervous system in the form of a dorsal tube; (2) an elastic skeletal rod, the *notochord*, underlying this; and (3) gill slits. In adults the notochord is usually wholly or partly replaced by a vertebral column, and the gill slits may have closed. There are four sub-phyla: (1) Hemichorda. Notochord small, and limited to the anterior part of the body. The worm-like Balanoglossus and two other unfamiliar marine forms are here included. (2) Cephalochorda. The lancelet (Amphioxus). (3) Urochorda. The degenerate ascidians or tunicata (q.v.). (4) Craniata. This embraces all the remaining vertebrates, which possess a distinct brain and skull. Divided into six classes: (i) Cyclostomata. Eel-shaped animals with suctorial mouths, devoid of limbs and jaws; lampreys and hags. The remaining five classes include jawed animals, that usually possess two pairs of limbs. (ii) Pisces. Fishes. (iii) Amphibia. Frogs, salamanders, &c. (iv) Reptilia. Reptiles. (v) Aves. Birds. (vi) Mammalia. Mammals. See separate articles.

Verticillium, a genus of Fungi Imperfecti, section Hyphomycetes. *V. albo-atrum* attacks the potato-plant, choking up the wood-vessels of the stem and causing the haulm to die prematurely, thus reducing the yield of tubers.

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[1] Memel district was handed over to Lithuania on 16th Feb., 1923, but was subsequently handed over to the League of Nations for disposal. Racially and geographically, Memel is part of Lithuania.

[2] *See Washington Conference.*

Vertue, George, English engraver, born in Westminster in 1684, died in 1756. He enjoyed the patronage of Sir Godfrey Kneller, and became engraver to the Society of Antiquaries in 1717. His best-known works include twelve portraits of poets and ten portraits of Charles I and his friends.

Verviers, a town of Belgium, in the province of Liége, on the Vesdre. It is celebrated for its manufacture of broad-cloth and woollen yarn, the staple of the town. There are also machinery, leather, and other manufactures. Pop. (1920), 43,027.

Vesoul, a town of France, capital of the department of Haute-Saône, on the Durgeon, an affluent of the Saône; served by the great trunk line Boulogne-Trieste, via Laon, &c., on which it is an important junction. There are vineyards in the vicinity, and furniture, &c., is made. Pop. 10,000.

Vespasia′nus, Titus Flavius, Emperor of Rome, was born near Reate, in the country of the Sabines, in A.D. 9, died in 79. After serving with distinction in Germany and in Britain as commander of a legion, he was made consul. He afterwards became proconsul of Africa, and on the rebellion of the Jews he was sent with an army into Judæa (A.D. 66). Vespasian reduced nearly all Galilee, and was preparing to attack Jerusalem when he received news of Nero's death (A.D. 68). Then followed the emperors Galba, Otho, and Vitellius, and in A.D. 69 Vespasian was himself elected emperor by the army, and arrived in Rome about the middle of the year 70, leaving the siege of Jerusalem to his son Titus. He immediately reformed the discipline of the army, purified the senatorial and equestrian orders, and improved the administration of justice. He also rebuilt a part of the city, restored the capitol, and erected the gigantic amphitheatre, the ruins of which are still celebrated under the name of the *Colosseum.*

Vesta, in Roman mythology, the goddess of the hearth. She was worshipped, along with the Penates, at every family meal, when the household assembled round the hearth, which was in the centre of the room. Her public sanctuary was in the Forum, and the sacred fire was kept constantly burning in it by the vestals, her priestesses. The vestal virgins are said to have been established by Numa. There were at first four, and afterwards six of them. They were taken from six to ten years of age. They were bound to virginity for thirty years, the term of their service, after which they were allowed to marry. Their persons were inviolable, and they were treated with great honour, and had important public privileges. The punishment of a vestal who broke her vow of chastity was burying alive. Theodosius abolished the vestal virgins in A.D. 394.—Cf. W. W. Fowler, *Roman Festivals.*

Vest-Agder, a southern, maritime *fylke* or county of Norway. Area, 2804 sq. miles; pop. 82,800.

Vesteraalen, a large archipelago lying off the north-west coast of Norway, 3° within the Arctic Circle; separated from the Lofoden Islands by the Raftsund. The largest island is Hindö.

Vestfold, a southern, maritime *fylke* or county of Norway, with a seaboard on Christiania Fjord. Area, 901 sq. miles; pop. 124,100.

Vestry, in English law, a meeting of the ratepayers of a parish convened for the discussion and settlement of parish affairs. Formerly it was customary for the parishioners to discuss in church, after service, notices given out thereat. Secular affairs predominated, and a feeling of the unseemliness of discussing these in church later led to the meetings being held in vestry. In vestry parish officials, such as churchwardens, assessors, collectors, assistant overseers, and surveyors of highways, were elected. At 'common vestries' every ratepayer could attend and vote. At 'select vestries' in the larger parishes the ratepayers were represented by vestrymen elected according to the custom of the parish. Until 1894 vestries had considerable powers of local government, but in all rural and some urban parishes these have been transferred to the parish councils and other bodies.

Vesuvius, a volcanic mountain of Southern Italy, 10 miles E.S.E. of Naples. It rises in the centre of a plain 2300 feet above the sea, in a pyramidal cone of about 1900 feet; total height, over 4000 feet, liable to alteration at eruptions. The cone is truncated, and about 2000 feet in diameter. Previous to an eruption about 1838 the top was an uneven plane, but was then converted into a hollow cup sloping to a depth of 500 feet. A precipitous rocky ridge, 1400 feet high, called Monte Somma, lies to the north of the cone, from which it is separated by a deep valley called the Atrio del Cavallo. At the western extremity of this valley an observatory is established. The lower belt of the sloping plain is about 2 miles broad; it is laid out in vineyards and well cultivated. Above this belt the plain is rugged and covered with scoriæ. Monte Somma is supposed to have formerly formed a complete cone of larger dimensions than the present one, being subsequently altered by volcanic forces in the same manner as 800 feet of the present cone were carried away by an eruption of 1822. The first recorded symptoms of activity exhibited by Vesuvius occurred in A.D. 63. In 79 a great eruption buried Herculaneum and Pompeii. The next recorded discharge of liquid lava was in 1036. Since then there have been many violent eruptions, the most noted of which were that of 1631, when 18,000 lives were lost, and that of 1906, when there were most violent outbursts, a great flow of lava, and some loss of life. Great outbursts took place in 1759, 1767, 1794, 1822, 1855, 1858, 1861, 1865, 1867–8, 1872, 1878, 1880, 1895, and 1906. A wire-rope railway was opened in 1880, and carries visitors to within a short distance of the crater.

Veszprém, a town of Hungary, north of Lake Balaton, with a fourteenth-century cathedral. It is a gardening-, wine-, and cereal-raising centre. Pop. 14,680.

Vetch, the popular name applied to plants of the genus Vicia, more especially to *V. sativa*, the common vetch or tare. The name is also applied, with various epithets, to many other leguminous plants of different genera; as, the *horse-shoe vetch*, of the genus Hippocrēpis; the *milk-vetch*, of the genus Astragălus; &c.

Veterinary Science. The power to examine candidates, and to grant to any suitable person a diploma which confers the right to practise as a veterinary surgeon, is vested by Royal Charter in the Royal College of Veterinary Surgeons, and no one can legally use the title veterinary surgeon unless he be a Member of the College. This body does no teaching, but attends to all matters affecting the interests of the profession, and elects the examiners, who may be veterinary surgeons, or specialists in certain subjects, such as chemistry. The examinations are five in number, one preliminary and four professional. A student, after passing the preliminary examination, requires to attend four years at one of the recognized teaching colleges, taking a professional examination each year. These teaching colleges are situated in London, Edinburgh, Glasgow, Dublin, and Liverpool. The higher degree of Fellow is granted, after another examination at a later date, to those already holding the diploma of membership. The administrative work of the profession is carried out by the Council of the Royal College of Veterinary Surgeons. This council is elected by the profession, a certain proportion retiring annually. A graduate may choose a career as a general practitioner; but there are also openings in the army, Ministry of Agriculture, county councils, and municipalities. There are many appointments abroad, but the salary offered is frequently not in proportion to the expenses and inconveniences incurred. Under the Agricultural authorities, veterinary surgeons carry out the administration of the Contagious Diseases (Animals) Acts, and examine stallions under the Horse Breeding Act. Unless an animal receives a sound certificate, he cannot travel for stud purposes. Any person found leading a stallion outwith his owner's premises without a certificate is liable to prosecution. In the hope of securing a supply of milk which shall be clean and free from the organism of tuberculosis, greater powers have been placed in the hands of veterinary surgeons acting on behalf of county councils and municipalities.

Tuberculin, originally introduced by Koch as a remedy for tuberculosis in human beings, has now found its chief use as a diagnostic agent for tuberculosis in cattle. It can be used in a variety of ways, producing in animals affected with tuberculosis either a local or general reaction. *Mallein*, prepared from the organism of glanders, and injected into suspected cases of glanders and in-contacts, has proved so reliable in diagnosis that Great Britain is free from this disease of horses. Glanders, once the scourge of armies in the field, was during the European War kept under control by the frequent testing of horses with mallein.

Active steps have been taken in recent years to produce agents known as vaccines, prepared from disease germs, and having the property, when they have been injected into an animal's system, of rendering the animal immune from the disease. The Animals' Diseases Research Association is a body of workers in this field which at present is dealing specially with braxy and dysentery in sheep, grass disease in horses, and joint-ill in foals. For joint-ill in foals the following method has given the most satisfaction. Inject into the mare a vaccine prepared from streptococci, staphylococci, and bacilli coli as soon after the seventh month of pregnancy as possible; give her three injections at weekly intervals. Immediately the foal is born it should receive an injection of anti-streptococcus serum, this to be repeated in seven days. In addition, the navel should receive a frequent dressing of an antiseptic such as strong tincture of iodine.

Milk fever, once a deadly affection amongst milk cows, has now a very low mortality, thanks to the efforts of a Danish veterinary surgeon, who suggested the inflation of the udder with air. When a cow becomes attacked with milk fever, the treatment consists of stripping the udder as empty of milk as possible, and the pumping of air into each quarter of the udder through a hollow needle introduced into each teat. Cows that are delirious frequently become quieter even before the whole of the quarters are inflated. As in human surgery, so in veterinary surgery the introduction of antiseptics and anæsthetics has made operations possible that were formerly impossible. It is only in the dog and the cat that abdominal surgery is carried out to any great extent. Foreign bodies in the stomach, intestines, and bladder are all removed in the dog and cat with good results, advantage being taken of X-rays in diagnosis. Roaring in horses, an incurable disease due to paralysis of one or both vocal cords, which was formerly only relieved by the performing of tracheotomy and the wearing of a permanent tube, is now alleviated by an operation introduced by Williams of New York, and largely practised in this country. The horse having been put under chloroform and laid on his back, the larynx is opened. If a horse roars from paralysis of the cord, one or both vocal cords will fail to move on respiration. The aim of the operation is to produce a shrinking or wasting of these cords, so that they will not lie dead in the passage. This result is brought about by removing the lining membrane of a cul-de-sac in front of the cord known as the ventricle, and it is hoped that in the healing process the contraction will be so great as to pull the paralysed cord hard up against the wall of the larynx.

Under the Anæsthetics Act certain specified operations on animals must either be performed under local anæsthesia or general anæsthesia. The horse and cow stand chloroform very well; the dog requires more care and attention; but sheep are most susceptible. Veterinary patients are frequently secured or cast before the anæsthetic is administered, as, during the period of excitement, they would be apt to break loose.

Veto (Lat., 'I forbid'), the power which one branch of the legislature of a State has to negative the resolutions of another branch; or the right of the executive branch of Government, such as King, President, or Governor, to reject the bills, measures, or resolutions proposed by other branches. In Britain the power of the Crown is confined to a veto, a right of rejecting and not resolving, and even this right is rarely exercised, the last occasion being in 1707; while the power of the House of Lords to veto bills which had passed the Commons was curtailed by the Parliament Act, 1911. In the United States the President may veto all measures passed by Congress, but after that right has been exercised the rejected bill may become law by being passed by two-thirds of each of the Houses of Congress.

Vevey, a town of Switzerland, in the canton of Vaud, on the north-eastern side of the Lake of Geneva. Pop. (1920), 12,768.

Vianna, a town of Brazil, in the state of Maranhao. It trades in cattle. Pop. 13,000.

Vianna do Castello, a town of Portugal, in the province of Minho, capital of the district of Vianna; served by the Oporto-Moncao Railway. It is one of the most beautiful towns of Portugal. There is a fishing industry which centres on the harbour, and trade is carried on in oil, wine, grain, &c. Pop. 12,000.—Another Vianna is in Alemtejo, on the Lisbon-Villa Real de San Antonio Railway.

Viareggio, a town of Tuscany, North Italy, in the province of Lucca, on the Ligurian Sea; served by the railway from Genoa and by a branch to Lucca. It is in the Riviera di Levante. Near by, at Bagni di Nerone, are the remains of the Roman baths. Pop. 14,000.

Viborg, a town of Denmark, on the Lake of Viborg. Manufactures include linen and tobacco. Pop. 10,885.

Viborg, or **Wiborg**, a seaport of Finland, capital of a province of the same name, on a deep inlet of the Gulf of Finland, 74 miles north-west of Petrograd. It has an active export trade. Pop. 35,000.

Vibrations. See *Sound*; *Harmonic Motion*; *Harmonics*; *Resonance*; *Wave Theory of Light*; *Wireless Telegraphy*; *Waves*.

Vibur'num, a genus of plants, nat. ord. Caprifoliaceæ, including the guelder-rose and laurustine (q.v.), and *V. Lantāna*, the wayfaring tree, a native of Europe and the west of Asia. The young shoots are used in Germany for basket-making; the wood is sometimes employed in turning and cabinet-making; the berries are used for making ink, and the bark of the root for making bird-lime.

Vic'ar (Lat. *vicarius*, substitute, from *vice*, in place of), in a general sense, a representative or vicegerent. The Pope calls himself *vicar of Christ on earth*. In the Church of England a vicar is the priest of a parish who receives only the smaller tithes or a salary, the greater tithes being received by a lay-rector. A *vicar apostolic*, in the Roman Catholic Church, is a bishop who possesses no diocese, but who exercises jurisdiction over a certain district by direct authority of the Pope; *vicar general*, the official assistant of a bishop or archbishop.

Vicenza (vi-chen'tsȧ), a frontier province of Venetia, North Italy. Area, 1056 sq. miles; pop. 548,200.

Vicenza, a town of Venetia, North Italy, capital of the province of Vicenza, on the Bacchiglione at its confluence with the Rentrone; served by the trunk line Venice-Milan, and the branch railway Treviso-Vicenza (38 miles). The older public buildings are almost all the work of Palladio, who was born here, or of scholars who rather slavishly imitated him. Such are the Duomo or cathedral; the Palazzo della Ragione (town-hall), an ancient Gothic building; the Museum, one of Palladio's finest buildings; the Palazzo-Prefetizzio; and the theatre. Manufactures include silk, woollen, and linen tissues, leather, earthenware, and hats. Pop. 57,016.

Vich (vich), a city of Spain, in the province of Barcelona, with cotton and other manufactures. Pop. 12,170.

Vichy (vē-shē; Rom. *Vicus Calidus*), a town and spa of France, in the department of the Allier. It was once a place of strength, and is celebrated for its thermal alkaline springs, twelve in number, known to the Romans as the *Aquæ Calidæ*. The Vichy waters are in much request for disorders of the stomach and bowels, and of the urinary organs, in gout, rheumatism, &c. The water is bottled for export. Pop. 16,502.

Vicksburg, a city and port of entry of Mississippi, United States, the county seat of Warren county, on the Mississippi at its confluence with the Yazoo; served by the Alabama & Vicksburg, and other railways. It has railway repair- and construction-shops, and has manufactures of cotton-seed cake and oil, and wooden goods, and a brisk trade in cotton. The district was settled in 1811, and the town, which became a city in 1836, was laid out in 1824. It was strongly fortified by the Confederates in the Civil War, and the Unionist forces were repulsed here on several occasions, but after a long siege General Pemberton surrendered the place to General Grant, 4th July, 1863. Pop. (1920), 17,931.

Victor Amadeus II, Duke of Savoy, and first king of Sardinia, born 1666, died 1732. He joined the Austrians in the War of the Spanish Succession, and at the Peace of Utrecht (1713) he obtained the addition of Sicily to his dominions. In 1720 he gave up that island to the Austrians in exchange for Sardinia, and then took the title of King of Sardinia. He abdicated in favour of his son, Charles Emmanuel III, in 1730.

Victor Emmanuel (Vittorio Emanuele) II, King of Sardinia from 1849 to 1861, and of Italy from 1861 to 1878, was born in 1820, and died in 1878. He was the son of Charles Albert, King of Sardinia, and on 12th April, 1842, he married the Archduchess Adelaide of Austria. His aptitude for a military career became evident when he commanded the Savoy brigades against Austria (1848–9), and distinguished himself in the battle of Goito by his reckless valour. After the battle of Novara (23rd March, 1849) his father abdicated, and Victor Emmanuel ascended the throne of Sardinia. He had then to negotiate with Austria under most unfavourable circumstances, but he steadily refused to give up the principle of representative government in the Sardinian Constitution, and this gained for him the name of honest king (*re galantuomo*) and the goodwill of the Italian people. This latter was only gained, however, after much calumny and misunderstanding, but the young king pursued from the first a policy which led to the national unity of Italy. Under the advice of his celebrated minister Cavour, he regulated the finances, reorganized the army, and secularized the Church property, for which he was excommunicated by the Pope. He took part in the Crimean War, and in 1859, assisted by France, renewed the contest with Austria, taking part in the battles of Magenta (4th June) and Solferino (24th June). By the Treaty of Villafranca and the Peace of Zürich which followed these successes, Lombardy was added to his dominions, but he had to cede Savoy and Nice to France. Parma, Modena, and Tuscany now became united to Sardinia, and Garibaldi's successes in Sicily and Naples brought the whole of Southern Italy over to Victor Emmanuel. On 17th March, 1861, he assumed the title of King of Italy, and early in 1865 Florence became the royal residence. By the Peace of Vienna (1866) Austria ceded Venetia, and on the withdrawal of the French garrison from Rome in 1870 the city was annexed to Italy, when the king entered Rome (2nd July, 1871) and took up his residence in the Quirinal. See *Sardinia*; *Italy*; *France*.

Victor Emmanuel III, King of Italy, born at Naples 1869, son of Humbert I and of Margherita. He entered the army, and frequently represented his father on important occasions abroad. In 1896 he married Princess Helena of Montenegro, and on the assassination of his father ascended the throne of Italy (11th Aug., 1900). When Italy joined the Allies in the European War, the king assumed command of the Italian armies on the Austrian front.

Victoria, Queen, Alexandrina Victoria, only child of Edward, Duke of Kent, fourth son of George III, by his wife, Mary Louisa Victoria, daughter of Francis, Duke of Saxe-Coburg, and widow of Ernest, Prince of Leiningen, was born on 24th May, 1819. Her prospect of the succession to the crown was somewhat remote, for her father might reasonably hope for a male heir; his three elder brothers were alive, and one of them, the Duke of Clarence, afterwards William IV, had recently married. The deaths of the princess's father in 1820 and of her cousins, two daughters of the Duke of Clarence, in 1819–20, placed her next in the succession to her two elderly uncles, the Dukes of York and Clarence. The Duke of York died in 1827, and on the accession of William IV in 1830 Victoria became heiress-presumptive to the throne. She had been brought up very quietly, but from 1830 she began to make public appearances, to the annoyance of King William, who was on very bad terms with the Duchess of Kent. Her coming-of-age, on her eighteenth birthday, was the occasion of some public rejoicings, and on 20th June of the same year (1837) she succeeded her uncle, creating a most favourable impression by the tact and composure which she displayed in difficult circumstances. Her accession involved the separation of the crowns of Great Britain and Hanover, the latter passing to the nearest male heir, her uncle, the Duke of Cumberland.

In the first years of her reign, Queen Victoria was under the guidance of her Whig Prime Minister, Lord Melbourne, who devoted himself to the task of training a young girl for her high responsibilities. The General Election, which by the then existing law followed her accession, gave the Whigs a reduced but adequate majority; but in the summer of 1839 Melbourne's position in the Commons became so weak that he resigned, and the young queen had her first political difficulties in a controversy with Sir Robert Peel, who, in taking office, proposed to replace the Whig Ladies of the Bedchamber by Conservatives. On her refusal, Peel declined to take office, and Melbourne returned to power for two more years; but the queen, who was taken by surprise and given insufficient time for consideration, afterwards admitted that she had been 'foolish', and no similar difficulty arose again. The influence of Melbourne diminished after the queen's marriage on 10th Feb., 1840, to her cousin, Prince Albert of Saxe-Coburg, whose wide interests and sagacious counsel had an important effect upon the development of the queen's character, though he never acquired popularity in his adopted country. Their first child, afterwards the Empress Frederick, was born on 21st Nov., 1840, and the Prince of Wales (Edward VII) on 9th Nov., 1841; seven other children followed between 1843 and 1857. During the years of her married life, Queen Victoria played a considerable part in foreign policy, and on several occasions her personal intervention improved foreign relations, especially with France. No sovereign of this country had left the island since George II (except for a brief visit of George IV to Hanover), but Queen Victoria made royal visits a part of the peace-loving diplomacy of her Governments, and she paid special attention both to Louis Philippe and Napoleon III, who owed to her his reception into the royal circles of Europe. She also showed an affection for Scotland (which, except for the visit of George IV to Edinburgh in 1822, had received no sovereign since the middle of the seventeenth century), and made one of her homes at Balmoral, in Aberdeenshire. Her relations with her ministers during this period were generally cordial, though she had grave disagreements with Palmerston, whose foreign policy she distrusted. Her desire for the maintenance of peace led, just before the outbreak of the Crimean War, to many misrepresentations of her attitude, which was supposed to be too friendly to Russia. The death of her husband (who in 1857 had been created Prince Consort) took place, from typhoid fever, on 14th Dec., 1861, and this event changed the whole tenour of the queen's life. During many years of her widowhood, Queen Victoria lived in almost complete seclusion. She had been the first sovereign to reside in Buckingham Palace, but after 1861 she was rarely in London, and preferred Balmoral and Osborne (her home in the Isle of Wight) to Windsor, and her disinclination to appear in public was the subject of numerous complaints. Her devotion to her other duties was, however, undiminished, and she continued to exercise some influence on foreign policy, and advocated neutrality in the Danish War of 1864. She was on terms of intimate friendship with one of the Prime Ministers of this period of her reign—Disraeli—and his Royal Titles Act of 1876, which conferred on her the dignity of Empress of India, gave her special pleasure. She did not like W. E. Gladstone, and did not conceal her reluctance to ask him to form a Government in 1880, and her distrust of his policy was increased by the course of events in Egypt and the Sudan. In the last years of her reign she welcomed the Unionist administrations of 1886 and 1895.

Queen Victoria suffered many family griefs, for two of her children and several of her grandchildren predeceased her. She felt deeply the loss of her son-in-law, the Emperor Frederick, in 1888. She had watched with anxiety the aggressive policy of Germany and Bismarck, and had warned her daughter that this country "cannot and will not stand" the attempt of the German Empire "to dictate to Europe", and she trusted that her son-in-law's succession would produce a change in German policy. Her sorrow was increased by the Emperor William's treatment of his mother, but she remained on cordial terms with her grandson to the end of her life. Her own domestic griefs rendered her sympathetic with the sorrows of her people, and as she grew older she more than recovered her early popularity, and was regarded with affection by the whole Empire. This affection was illustrated by the enthusiasm for her person which was shown on the occasions of her jubilees in 1887 and 1897. Her last years were clouded by the outbreak of the South African War and by the disasters of the opening campaign, but she lived long enough to welcome Lord Roberts on his return in Jan., 1901. She died less than three weeks later, on 21st Jan., 1901, and was buried at Frogmore, near Windsor, on 4th Feb., the funeral service taking place at Windsor on 2nd Feb. Queen Victoria was a woman of robust physique, remarkable powers of memory, great force of character, deep sympathy, and sincere religious feeling. She was very tenacious of her own opinions, but understood thoroughly the position of a constitutional sovereign, and her strong common sense kept her prejudices in check. She has left a great name on the roll of British sovereigns.—BIBLIOGRAPHY: A. C. Benson and Lord Esher (editors), *The Letters of Queen Victoria (1837–61)*; Sir Sidney Lee, *A Life of Queen Victoria*; G. Lytton Strachey, *Queen Victoria.*

Victoria, a British colony in the south-east of Australia, bounded north by New South Wales, south-east by the Pacific, south by Bass Strait and the Southern Ocean, and west by South Australia; area, 87,884 sq. miles (see table under *Queensland*).

Physical.—There is a coast-line of 680 miles (i.e. 129 sq. miles of area to 1 mile of seaboard). The state is traversed by the Victorian Highlands, a western projection of the East Australian Highlands, which, as the Australian Alps (Mt. Bogong, 6508 feet altitude) and the Great Dividing range, run from east to west with decreasing altitude across Victoria and form the watershed between streams flowing to the Murray, the northern boundary of the state, and those belonging to the hydrographic system of the Great Valley of Victoria in the south. Trending north and south at the western end of the Victorian Highlands are the Grampians (Mt. William, 3827 feet altitude). In the northwest of the state are the Mallee Plains, part of the Great Plains, so called from the Mallee (*Eucalyptus Dumosa*) which formerly covered them. Part of the Great Valley lying west of Port Phillip is covered with lava flows discharged from many volcanic vents, some of which show only by the worn plug of lava that stopped the pipe of the volcano, while others are still covered by volcanic hills. These lava plains, covering about 9000 sq. miles of Western Victoria, are studded with lakes, both salt and fresh, and have such a good rainfall and rich covering of turf as to turn the attention of the first settlers inevitably towards pastoral pursuits. Rivers flowing northwards to the Murray include the Mitta-Mitta, Ovens, and Goulburn; those flowing to Bass Strait, &c., comprise the Snowy, Mitchell, Macallister, and Glenelg Rivers. Most of the latter find their way into lagoons pent up behind storm beaches, such as the Ninety Mile Beach (which encloses the noted Gippsland Lakes, Wellington, Victoria, and King respectively) on the eastern seaboard, and from these lagoons disembogue to the sea. The Yarra-Yarra, upon which Melbourne stands, discharges into Port Phillip Bay.

The climate is temperate, with a mean annual temperature of 58·4° F. (July, 48·6°; January and February, 67·5°), rainfall (66 years observations) about 25·66 inches per annum.

Victoria is the second gold-producing state of Australia, the metal being found in the district of Bendigo, Gippsland, Maryborough, Beechworth, Ballarat, and Ararat and Stawell. Lode workings are the chief, but there are considerable alluvial workings. Iridosmine exists at Foster and Waratah, and platinum is found (associated with copper) in Gippsland. In order of value the mineral production is gold, coal, tin and tin ore, antimony ore, phosphate, molybdenite, kaolin, silver, gypsum, diatomaceous earth, gems, and wolfram. The pastoral industry is all-important. Wool is the chief product, and the sheep-walks are very extensive. Beef-production and dairying, including the making of butter, cheese, condensed milk, and other milk-products, are progressive. About 50 per cent of the agricultural area is devoted to wheat, 30 per cent to hay, 10 per cent to oats (Victoria being the leading oat-producing state of Australia), and the rest to viticulture, fruit-farming (apples, apricots, peaches, pears, and plums), and to crops such as barley, of which, after South Australia, Victoria produces the heaviest crops in the Commonwealth. Manufactures include leather and other products connected with the pastoral industry, clothing and textile fabrics, food, drink, and wooden goods, &c.

Victoria is divided officially into thirty-seven counties. The government is vested in a Governor appointed by the Crown, aided by a ministry of eight salaried members, and a Parliament consisting of a Legislative Council of thirty-four members elected for six years, one half seeking re-election every three years, and a Legislative Assembly of sixty-five elected for three years. Education is compulsory between the ages of six and fourteen years. Besides the Melbourne University there are several colleges connected with various religious denominations.

Victoria was first colonized from Tasmania in 1834. It made rapid progress, especially in sheep breeding, and the discovery of gold in 1851 caused a rush of population from all parts. Hitherto it had been known as Port Phillip, and formed part of New South Wales, but in this year (independently of the gold discovery) it was erected into a separate colony under the name of Victoria. In 1850 the population numbered 76,162; in 1854 it was 312,307. In 1856 responsible government was conferred on the colony, and in 1900 became a state of the Australian Commonwealth. The chief towns are Melbourne (the capital), Ballarat, Bendigo, and Geelong. Pop. in 1881, 862,346; in 1891, 1,140,405; in 1901, 1,201,341; and in 1923, 1,550,952. In Melbourne alone (pop. Dec., 1921, 795,100) 51·27 per cent of the population of the state is concentrated.

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Victoria, capital of British Columbia, at the south end of Vancouver Island, on an inlet from the Strait of Juan de Fuca; served by steamers and by the Esquimault & Nanaimo Railway, of which it is the terminus. Victoria was founded in 1828, and has developed into a seaport of importance with many industries, including the manufacture of paints, canned goods, biscuits, dried fish, jams, machinery, soap, and bricks. Esquimault, 3 miles distant, is a naval station, and has a Dominion Government dry dock. Pop. 39,000.

Victoria, a seaport-city of Brazil, capital of the state of Espirito Santo; served by rail to Rio. Coffee is the main article shipped, but tapioca, rice, and sugar are loaded by coasting steamers. Pop. 20,000.

Victoria, a large island of Northern Canada, in the district of Franklin. It is separated from the mainland by Coronation Gulf, Dease Strait, Queen Maud Sea, and Dolphin and Union Strait. It comprises Prince Albert Land and Wollaston Land.

Victoria, the name of several towns in British colonial possessions: (1) a seaport-town (pop. 1500), the capital of Labuan (q.v.); (2) a town of Southern Rhodesia (q.v.); (3) the capital and harbour of the Seychelles, on Mahé, an Admiralty coaling-station; (4) the seaport-capital of Hong-Kong (q.v.); and (5) a seaport-town in the British sphere of the former German *Kamerun*, the centre of large cocoa, rubber, and banana plantations; gives name to one of the four districts (Bamenda, Ossidinge, Victoria, Kumba) forming a division administered by a resident with head-quarters at Buea. Victoria and Sopo (1½ miles below Buea) are connected by light railway. Pop. about 2500.

Victoria, Lake, a lake of East Africa, about 400 miles inland from the Indian Ocean, crossed near its north end by the equator, about 3800 feet above the sea; area, 29,000 sq. miles, or nearly as large as Scotland. It communicates with Lake Albert by means of the Victoria Nile, and is the principal feeder of the White Nile. It contains many islands, some of them of considerable size. It was discovered by Captain Speke in 1858. It is entirely within British territory, and is easily reached by railway from Mombasa.

Victoria and Albert Museum. See *Kensington (South) Museum*.

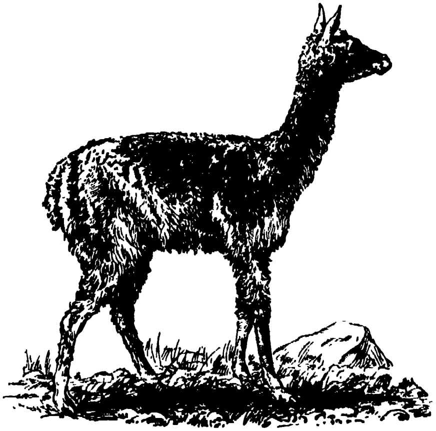
Victoria Cross, a decoration instituted on 29th Jan., 1856, at the close of the Crimean War, for the purpose of signalizing special individual acts of bravery. It may be conferred upon those holding any rank in the navy, army, or Air Force, and carries with it a pension of £10 to ratings and non-commissioned officers and men. The decoration is a bronze cross *patée* with the royal crown in the centre, surmounted by the lion, and underneath a scroll bearing the inscription 'For Valour'. It is made from the metal of cannon captured at Sebastopol. Additional acts of bravery are recorded by extra bars affixed to the ribbon (1½ inches in width) suspending the Cross. Prior to 1918 this ribbon was blue for naval recipients and red for military ones; it is now red for all three services. Since 1918 a miniature replica of the decoration has been worn on the ribbon in undress and service dress uniform. Native officers and men of the Indian army were made eligible for the Victoria Cross in 1912. Recipients place the letters V.C. after their names. Between 1856 and 1914 about 525 Victoria Crosses were awarded; during the European War 581 were given. An illustration of the Cross is given on the plate facing page 358 of vol. vii.—Cf. Major Rupert Stewart, *The Book of the Victoria Cross*.

Victoria Falls, a cataract of the Zambezi, in Rhodesia, not far from its western boundary. The river here, nearly a mile broad, drops 340 feet into a narrow transverse fissure or crack crossing its course, the water then passing away in a narrow rocky gorge. A great railway bridge now crosses the river here; and it has been proposed to utilize the falls to generate electric power for the Johannesburg gold-mines and other purposes.

Victorian Order, The Royal, a British order of knighthood established by Queen Victoria in April, 1896. There is no limit to the number of members, and the order, which is conferred for extraordinary, important, or personal services to the sovereign or the royal family, can be bestowed upon foreigners as well as upon British subjects. The order is divided into five classes: Knights Grand Cross (G.C.V.O.), Knights Commanders (K.C.V.O.), Commanders (C.V.O.), and Members of the Fourth and Fifth Classes (M.V.O.). The ribbon of the order is dark blue with a narrow edge of red, white, and red.

Victoria University, formerly a federal university consisting of Owens College, Manchester, University College, Liverpool, and Yorkshire College, Leeds. It was founded by Royal Charter in 1880, but in 1903 the Liverpool college was separated to form the University of Liverpool, and the other two colleges received separate charters in 1904 as the Victoria University of Manchester and the University of Leeds. Among distinguished scientists who have been associated with Victoria University are the chemists Roscoe, Pope, and W. H. Perkins; the physicists Balfour Stewart, Schuster, and Rutherford; and the engineers Reynolds and John T. Nicolson.

Vicuña (vi-kụn'yȧ), a ruminant animal (*Lama vicugna*) closely allied to the llama. It is a native of South America, frequenting the slopes of the Andes of Chile, &c., near the region of perpetual snow, and somewhat resembles the chamois in its habits. See *Llama*.



Vicuña (*Lama vicugna*)

Vienna (Ger. *Wien*), the capital of Austria, on the right bank of the River Danube; the nodal point of the Austrian railways. The city consists of the Innere Stadt, or old town, and numerous municipal districts, besides extensive suburbs. The old town is encircled by the magnificent avenue of the Ringstrasse, marking the site of the ancient fortifications, which till 1856 protected the city against Asiatic foes. The Prater, a public park on the bank of the Danube, is considered the finest public park in Europe. Of the churches the chief is the Domkirche, or cathedral of St. Stephen, a cruciform Gothic structure of the fourteenth and fifteenth centuries. Its main tower, about 450 feet in height, was built between 1359 and 1433, and partly reconstructed between 1860 and 1864. It contains a bell weighing over 20 tons, and cast from captured Turkish cannon. The other noteworthy churches are: the Augustinian church (1330), containing the hearts of the dead members of the Habsburg family; the Bohemian National church (Maria am Gestade), built 1340–94 and restored 1820; the Italian National church (Maria-Schnee); the University or Jesuit church (1628–31), in Late Renaissance style; the Capuchin church, with the burying-vault of the Habsburgs; the Votiv-kirche (1856–79), one of the finest examples of modern Gothic. The former imperial palace (Kaiserliche Hofburg), in the heart of the city, is a large and ancient structure, with modern additions. Among other buildings are Parliament building (1883), in Greek style, the town-house (1872–83), the Palace of Justice (1875–81), in German Renaissance style, the museums of art and natural history, both Renaissance buildings, and the Exchange. The university was founded in 1365. There are also theological institutes, an academy of fine arts, a conservatoire of music, public libraries and museums, and a number of gymnasia and other schools. Some of the collections in the museums and galleries are among the finest in the world. The principal theatres are the Hofburg and the fine Opera House. Manufactures include silks, woollens, cottons, machinery, cycles, scientific instruments, musical instruments, safes, furniture, art objects, jewellery, chemicals, beer, leather goods, artificial flowers, &c. There is a large trade both by rail and river. The mean annual temperature is 48·7° F. (January, 29°; July, 68°), and the rainfall about 24·5 inches. May to August inclusive are the wettest months, and February is the driest.

Vienna, the pre-Roman *Vindomina*, was the Roman *Vindobona*, the head-quarters first of the XIIIth, then of the Xth Legion, and the place where Marcus Aurelius died. Taken by the Ostrogoths and the Huns, Charlemagne seized it about 791; it became the seat of the Margraviate of Austria (1142) and a free imperial city (1237). Rudolf von Habsburg seized the city in 1276, and it became thenceforth the seat of the Habsburgs until the downfall of the Austrian Empire in 1918 (see *Rudolf I*, &c.). Among noted sieges were those of the Turks in 1529 and again in 1683. In 1723 the bishopric (dating from 1480) became an archbishopric. The French seized the city in 1806 and 1809, and the Congress of Vienna (q.v.) sat there (1814–5). From being the capital of an empire, Vienna has now sunk to the peculiar position of capital of a second-rate state. Pop. (1920), 1,841,326.

Vienna, Congress of (1814–5). The Congress of Vienna met in Sept., 1814, to determine the settlement of Europe after the abdication of Napoleon in April and the conclusion of the First Peace of Paris in May. That treaty, the signature of which restored France to a place among the European Powers, provided only for immediate necessities, and relegated many important questions to a Congress in which France was represented by Talleyrand, who soon found among the Allies differences of opinion, which enabled him to secure support. Progress was long delayed by disputes, and it was not until Jan., 1815, that the 'real Congress', composed of representatives of Great Britain, Austria, Prussia, Russia, and France, began to draft a treaty. Their deliberations were interrupted by the escape of Napoleon from Elba, but they were concluded a few days before the battle of Waterloo. It was agreed that Germany (including Austria) should become a confederation of thirty-eight states by the amalgamation of many of the small states which had existed before the revolutionary wars. Prussia was given a large increase of German territory, including the Rhineland. Austria was made the president of the German Confederation, and received Lombardy and Venice. Elsewhere in Italy, the states of the Church were restored to the Papacy, and Naples and Sicily to their Bourbon monarch. Belgium was united with Holland, and Great Britain acquired colonial possessions, including Malta, Heligoland, Ceylon, and the Cape of Good Hope. After the defeat and surrender of Napoleon, these arrangements were challenged by the Prussians, who advocated the dismemberment of France, but the British representatives in the Allied councils, Castlereagh and Wellington, opposed a policy of spoliation and were supported by Russia and Austria. The Prussians had to give way, and the Second Peace of Paris (Nov., 1815) did not seriously alter the arrangements made in the First Peace and at the Congress of Vienna. The settlement made by the Congress was guided by the belief that revolutions must lead to war and that a series of strong monarchies formed the best guarantee of European peace, and by the principle of maintaining a balance of power. The dislike of its members to constitutional government was the weakest point in the settlement; its strongest was the creation of something like a Concert of Europe, which did, in fact, keep the peace for a considerable number of years. The 'Holy Alliance', often associated with the Congress, was actually founded after its close, and was merely a pious opinion, expressed by Russia and formally accepted by Prussia and Austria. It had no political influence, but the Quadruple Alliance, made in November by Britain, Russia, Austria, and Prussia, provided for the assembly of congresses to settle disputed questions.—BIBLIOGRAPHY: C. K. Webster, *The Congress of Vienna*; R. B. Mowat, *A History of European Diplomacy in the Nineteenth Century*; *Cambridge History of British Foreign Policy*.

Vienne (vē-enn), a western department of France, in the old province of Poitou, bounded by the departments of Indre-et-Loire, Indre, Haute-Vienne, Charente, Deux-Sèvres, and Maine-et-Loire; area, 2711 sq. miles. The surface is generally flat; it is well watered, chiefly by the Vienne and its tributaries. Wheat, oats, barley, rye, fruit, and wine are produced, and cattle and sheep are raised. Iron is worked, and there are also stone-quarries. Manufactures include woollens, lace, cutlery, paper, and pig-iron. The capital is Poitiers. Pop. (1921), 306,248.

Vienne (Rom. *Vienna Allobrogum*), a town of France, in the department of Isère, on the Rhône, at the confluence of the Gère; served by the trunk line of the Paris-Lyons-Mediterranean Railway. It has an ancient cathedral. Vienne contains numerous Roman remains, and figures prominently in ecclesiastical history. It was formerly the seat of an archbishop. Pop. 25,710.

Vienne, Haute-, a hilly department adjoining the department of Vienne on the south-east; area, 2119 sq. miles. Almost the whole department belongs to the basin of the Loire, and it is crossed by the upper course of the Vienne. The principal crops are buckwheat, rye, beans, and peas; and horses, mules, and swine of a superior breed are reared. Minerals include iron, copper, tin, lead, coal, antimony, and kaolin. Porcelain, woollen and other tissues, paper, and leather are the chief manufactures. Limoges is the capital. Pop. (1921), 350,235.

Viernheim, a town of Germany, in the Hessian province of Starkenburg; a railway junction on the lines Weinheim-Mannheim and Weinheim-Lampertheim. Cigar factories provide the chief employment; other industries are malting, sawmilling, and the brewing of beer. Pop. 10,000.

Viersen, a town of the Rhineland, Germany, in the Düsseldorf district, on the Niers; a junction on the railway München-Gladbach-Ruhrort. Industries include the manufacture of silks, plush and satin, linen and cotton, machinery, paper, chocolates, leather, and electrical goods. Pop. 30,000.

Vierzon, a town of France, in the department of Cher, on the Yèvre at its confluence with the Cher, and on the Canal du Berry; a junction on the main line Paris-Orleans-Toulouse, for Montluçon and Laqueville (150 miles), and for Tours. Manufactures include porcelain, glass, and agricultural machinery. Pop. 11,860.

Vieta, Franciscus, or François Viète, French mathematician, born 1540, died 1603. He made important advances in algebra, especially in methods for solving equations, and was the first to solve the celebrated problem of Apollonius—to describe a circle to touch three given circles—without the aid of conic sections.

Vigevano (vi-jev'à-nō), a town of Italy, in the province of Pavia, near the right bank of the Ticino, 15 miles S.S.E. of Novara. It is a bishop's see, and has manufactures of silks, hats, soap. and macaroni. Pop. 20,000.

Vigfusson, Gudbrandr, Icelandic philologist, born in 1828, died in 1889. He studied in Copenhagen, but was called to England in 1864 to complete the *Icelandic-English Dictionary*. This work was published between 1869 and 1874, and in 1884 Vigfusson was appointed reader in Scandinavian at Oxford.

Vigny (vēn-yē), Alfred Victor, Comte de, French poet, novelist, and dramatist, born in 1797, died in Paris in 1863. A small volume of *Poèmes* published in 1822 attracted little attention. It was followed by the more important *Poèmes Antiques et Modernes* in 1826, containing such finely mystical pieces as *Moïse*, *Éloa ou La Sœur des Anges*, and *Le Déluge*. The same year witnessed the appearance of the historical novel *Cinq-Mars ou une Conjuration sous Louis XIII*, which shows the influence of Sir Walter Scott. De Vigny's first theatrical venture was a translation of *Othello* (1829); it was followed by *La Maréchale d'Ancre* (1831) and *Chatterton* (1835), the latter of which was brilliantly successful. Other works are *Consultations du Docteur Noir* (1832), *Servitude et Grandeur Militaires* (1835), and the posthumous *Les Destinées* (1864), the first two in prose, the last a philosophical poem. A part of his journal was given to the world in 1867. From 1845 he was a member of the Academy. De Vigny was associated with the romantic movement in French literature, but he stands apart from its main stream. Grandeur, simplicity, and solemnity are the dominant characteristics of his poetry, and his outlook is that of pessimistic stoicism.—Cf. E. Lauvrière, *Alfred de Vigny*.

Vigo, a city and seaport of North-Western Spain, in the province of Pontevedra, on the south side of the Ria de Vigo, on the slope of a hill crowned by a fort, 80 miles s.s.w. of Corunna. The fishing of sardines and tunnies is important, and there is an active foreign trade. The sea-bathing is excellent. On 12th Oct., 1702, Admiral Rooke at the head of an English fleet completely defeated a Franco-Spanish fleet in the bay and captured a large amount of treasure. Pop. 41,500.

Vikings, Wickings, or **Northmen,** sea-rovers from the Scandinavian Peninsula who migrated, in successive waves, to France, Flanders, and the British Islands from the eighth century to the thirteenth. At first they were mere freebooters who landed in a creek and ravaged the district, their light vessels being capable of navigation up river-mouths, but from the middle of the ninth century they began to make permanent settlements. In 845, 857, 861, and again in 886, they attacked Paris, and some of them at this date penetrated to the Mediterranean and the coasts of Italy. Their first great settlement was in the north of France, where Rolf, the leader of a band of Northmen, received from Charles the Simple territory between the Channel, the Seine, and the Epte, which his son subsequently extended to form the Duchy of Normandy, and the Normans thenceforth played a large part in the history of France and, afterwards, in that of England and Italy. The invaders who settled in England in the ninth, tenth, and eleventh centuries, and against whom Alfred and his descendants waged war, were Danes and not Norsemen; but the Norsemen made numerous settlements in Ireland and in Scotland, where Olaf the White founded in 852 a Scandinavian kingdom, including both Danes and Norsemen. In Scotland they began to attack the west coast in 794, and they soon made settlements there, both on the mainland and in the islands, including Orkney and Shetland, whence they migrated into Caithness and spread along the coast as far south as the Moray Firth. Other bands formed colonies in Dumfriesshire and Kirkcudbrightshire, and penetrated inland to Peebles. In the Western Islands, in Orkney and Shetland, and in Caithness the population became definitely Scandinavian, and these regions belonged for some centuries to the Kingdom of Norway. The Vikings also colonized Iceland and portions of Greenland, and they even made their way to North America. Other settlements were made in Russia, and Norsemen formed the Varanger Guard at Constantinople. The Vikings were heathens, and their ravages were unrestrained by any feelings of pity or of reverence for religion. Their character is described in the Eddic poems, which contain much of the romance of their history; they are described by York Powell as " a sturdy, thrifty, hard-working, law-loving people, fond of good cheer and strong drink, of shrewd, blunt speech . . . truthful, hospitable, liking to make a fair show, but not vain or boastful ". To these qualities must be added remarkable skill and not less remarkable daring in navigation and in fighting, and remorseless cruelty. Relics of their vessels have been found in the Thames, the Lea, the Seine, and elsewhere, and show the resources of these early shipbuilders.—BIBLIOGRAPHY: Collingwood and York Powell, *Scandinavian Britain*; *Cambridge Mediæval History*; A. H. Johnson, *The Normans in Europe*.

Villach, a town of Carinthia, Austria, on the Drave, near the confluence of the Gail; an important railway junction on the lines Leoben-Pontebba (via Tarvis), Marburg-Franzensfeste, and Salzburg-Assling, with a branch line to St. Veit (32 miles). Villach is primarily an industrial town, producing paper goods, colour and varnish, machinery, preserved fruit, leather, and beer. A large trade is carried on, notably in wood, with Italy. Near by are the thermal springs (sulphuric; about 84° F.) of Villach with *Kurhaus*, &c. Pop. 16,500.

Villafranca, the name of several Italian towns. (1) A town of Verona, on the Tartaro; served by the railway Bologna-Brenner. It was the centre of the wars of 1848 and 1866, and was the place where peace was signed (11th July, 1859) between Napoleon III and the Emperor of Austria. Pop. 12,000. (2) Villafranca in *Modena*, a junction for Finale on the railway to Mirandola. (3) Villafranca in *Lunigiana*, on the railway from Parma to the west coast. (4) Villafranca *Piemonte*; served by rail from Turin.

Villafranca, the name of several Spanish towns: (1) *de los Caballeros*, in Toledo province; (2) *del Bierz*, in Leon, terminus of a branch line from Toral de los Vados; (3) *del Campo*, in Teruel and in the Jiloca Valley; (4) *del Cid*, in Castellon; (5) *de los Barros*, in Badajos, on the Sevilla-Merida Railway; (6) *del Panades*, in Barcelona; (7) Villafranca in Guipuzcoa, on the railway San Sebastian-Zumarraga; (8) Villafranca in Navarra, on the railway Pamplona-Castejon.

Villanelle, one of the fixed forms of verse, originally a rustic song of any kind, but since the sixteenth century a very rigorously defined form. Florio in his *Italian-English Dictionary* (1598) translated *villanella* by "a ballat, such as countrie milke-maids sing". The word is ultimately derived from the Lat. *villa*, a farm, through the It. *villano*, a farm-hand. The villanelle was a pastoral poem made to accompany a rustic dance, and, though a refrain was always a necessary constituent, it originally obeyed no laws. The present strict rules which govern the villanelle are due to Jean Passerat (1534–1602), who wrote a poem which has become as much the standard villanelle as the bronze bar deposited with the Standards Department is the standard yard. This famous poem commences:

J'ai perdu ma tourterelle;
Est-ce point celle que j'oi?
Je veux aller après elle.

The villanelle is written in five three-lined stanzas, concluding with one of four lines, and is therefore nineteen lines in length. The refrain occupies eight of the nineteen lines; taken from the first and third lines of the first stanza, the two supply alternately the last line from the second to the fifth stanza, and both conclude the quatrain which ends the villanelle. Two rhymes only are allowed. The first refrain, therefore, concludes the second and fourth stanzas, the second refrain concludes the first, third, and fifth stanzas, and both refrains conclude the sixth and last stanza. The two refrains have the same rhyme. The scheme of the villanelle is as follows (the capital letter denotes the refrain, 1 the first refrain, and 2 the second): A^1, b, A^2 | a, b, A^1 | a, b, A^2 | a, b, A^1 | a, b, A^2 | a, b, A^1, A^2. Like other artificial kinds of verse, the villanelle is intolerable when written by an unskilled workman; a cunning artificer can make of it a delightful poem. The villanelle was originally a shepherd's song, and later writers have usually selected pastoral or idyllic subjects for this dainty form of verse. A fine example of a villanelle is one addressed by Oscar Wilde to the king of pastoral poets, Theocritus:

O Singer of Persephone!
  In the dim meadows desolate
Dost thou remember Sicily?

Still through the ivy flits the bee
  Where Amaryllis lies in state;
O Singer of Persephone!

Simætha calls on Hecate,
  And hears the wild dogs at the gate;
Dost thou remember Sicily?

Still by the light and laughing sea
  Poor Polypheme bemoans his fate;
O Singer of Persephone!

And still in boyish rivalry
  Young Daphnis challenges his mate;
Dost thou remember Sicily?

Slim Lacon keeps a goat for thee;
  For thee the jocund shepherds wait;
O Singer of Persephone!
Dost thou remember Sicily?

Villars (vil-ăr), Claude Louis Hector, Duc de, French soldier, born in 1653, died in 1734. In the Wars of the Spanish Succession he was sent to co-operate with the Elector of Bavaria. He defeated Prince Louis of Baden at Friedlingen, 14th Oct., 1702, for which he received the marshal's baton; and having joined the Elector, he defeated the Prince of Baden at Höchstadt, 21st Sept., 1703. His success in dealing with the insurrection of the Camisards obtained for him the title of duke (1705). He was in command at Malplaquet, and in 1712 defeated the Allies at Denain.

Villefranche (*de Rouergue*), a town of France, in the department of Aveyron, at the junction of the Alzou with the Aveyron; served by the Orléans Railway. Pop. 10,000.

Villefranche (*sur-Saône*), a town of France, in the department of Rhône, on the Saône; served by the Paris-Marseilles trunk line (P.L.M.), and by branches to Tarare and Monsol (via Beaujeau). Pop. 16,000.

Villehardouin (vil-ăr-dụ-aṇ), Geoffroy de, French historian, born about 1160, died about 1213. He took an important part in the fourth Crusade, was present at the siege and capture of Constantinople, and when the Greek emperor was overthrown and Baldwin established in his stead, he received an extensive territory for himself in Thrace. His *Histoire de la conquête de Constantinople* is one of the most valuable historical works of the Middle Ages.

Villeins. See *Serfs, Villeins, and Villeinage.*

Villeneuve (vēl-neuv), Pierre Charles Jean Baptiste Silvestre de, French admiral, born in

1768, died in 1806. He entered the navy in 1777, and became rear-admiral in 1796. He led the rear division at the battle of the Nile, and escaped with his own and four other ships to Malta. In 1804 he was made vice-admiral, and in 1805 Napoleon appointed him to the command of the Toulon squadron. Defeated at Trafalgar in 1805, he was taken as prisoner to England. In April, 1806, he was released and returned to France, but learning that his reception by the emperor would be unfavourable, he committed suicide.

Villeneuve (Ger. *Neustadt*), a town of Switzerland, canton Vaud, on the east shore of Lake Geneva; served by the railway Lausanne-Brig. It is noted for white wine. Chillon (the castle) is near by. Pop. 3000.

Among other Villeneuves (*all in France*) are: *d'Aveyron*, department Aveyron; on Figeac-Villefranche railway; pop. 2000: *d'Agen* or *sur-Lot*, depart. Lot-et-Garonne, on the Lot; and on Penne-Tonneins railway; plum-trading centre; pop. 12,000: *de-Berg*, depart. Ardèche; on Alais-Le Teil railway; silk-spinning place; pop. 2000: *de-Marsan*, depart. Landes; on railway from Mont de Marsan; thermal baths at Brousté; pop. 3000: *la-Guyard*, depart. Yonne; on Sens-Montereau railway; pop. 2000: *l'Archevêque* or *sur-Vanne*, depart. Yonne, on the Vanne; on Sens-Troyes railway; a great horse-trading centre; pop. 2000: *le-Comte*, depart. Seine-et-Marne; on railway Lagny-Mortcerf; pop. 3000: *lès-Avignon*, depart. Gard, on Rhône opposite Avignon; and on Lyons-Nimes railway; olive-oil made; pop. 3000: *les-Béziers*, depart. Hérault; on Béziers-Agde railway: *St.-Georges*, depart. Seine-et-Oise, on the Seine; on the P.L.M. (Paris-Moret section) and the Noisy-le-Sec-Juvisy circular railways; pop. 7000: *sur-Yonne*, depart. Yonne, on the Yonne; and on Sens-Joigny (section P.L.M.) railway; wine- and grain-trading centre, founded by Louis VII (1163); pop. 5000.

Villers-Cotterets, a town of France, in the department of Aisne; the junction for Compiègne, Pierrefonds, and La Ferté Milon, on the Paris-Soissons line (Northern Railway). It is especially noted as the birth-place (1885) of Dumas *père*, and is dealt with at length in his *Memoirs* (English translation in 6 vols.). Pop. 6000.

Villon, François, one of the greatest of the French lyric poets of the modern school, born at Paris in 1431, died probably in 1485. His real name was François de Montcorbier, but he adopted the name of his guardian, Guillaume de Villon, a priest. Educated at the University of Paris, he graduated bachelor of arts in 1449, and master in 1452, but fell into a disreputable way of living, and was more than once under sentence of death for his crimes. He was again under sentence of death in 1462, but his sentence was commuted to banishment. Villon's works include *Le Petit Testament* (1456), a poem in 40 stanzas; *Le Grand Testament* (1461), a poem in 173 stanzas; and numerous ballads. The *Grand Testament* reflects most vividly the whole range of Villon's life, depicting his joys and sorrows, his misdeeds and remorse, and is distinguished by humour, sincerity, feeling, and poetical power. Villon's poetry is intensely subjective, and on account of his frankness and sincerity his writings may be considered as a fairly trustworthy picture of his times. The first edition of his works appeared in 1489, whilst one of the best recent editions is that of Longnon (Paris, 1892).—BIBLIOGRAPHY: G. Paris, *François Villon*; R. L. Stevenson, *Familiar Studies of Men and Books*.

Vilna (Lith. *Vilnius*), capital of Lithuania; the railway centre of the country, on the Petrograd-Warsaw trunk line, and lines to Eydtkuhnen (for Berlin) and Rovno (in the Polish county of Wolyn). Trade is mainly in wood and grain, and manufactures include leather and alcohol. In 1914 there were fifteen newspapers and periodicals, five being dailies. The mean annual temperature is 43·5° F. (January, 22°; July, 64·5°), rainfall about 22 inches. Pop. estimated at 214,000 (largely Jewish). It was ninth town of Imperial Russia in point of population.

First mentioned in 1128, Vilna was, from 1322 to 1795, capital of Lithuania, and here Yagello, newly converted to Christianity, erected the first Lithuanian cathedral (1387). Alexander I founded a university (1576), which was suppressed in 1832 after the Polish insurrection, Lithuania having been added to Russia in 1795. Napoleon occupied the town in 1812. During the European War (q.v.) Vilna fell to the Germans on 18th Sept., 1915, and on the break-up of the Russian Empire its possession was disputed by the Poles and the Letts, the former claiming the town on ethnic grounds, and the latter on those of Lithuanian history. In Oct., 1920, the Poles occupied the town, and the matter was finally submitted to the League of Nations for settlement, the Lithuanian capital being temporarily set up at Kovno.

Vimeiro (vi-mā′i-rų), a village of Portugal, in Estremadura, near Torres Vedras. It is remembered as the scene of the battle between Wellington and Junot (21st Aug., 1808), which was followed by the Convention of Cintra (30th Aug., 1808).

Vincennes, a town of France, in the department of the Seine, about 2 miles east of Paris, of which it forms an eastern suburb. Its large old castle was once the residence of the French kings, but was converted into a State prison by Louis XI. A new fort and an arsenal were constructed between 1848 and 1852. After the siege of Paris by the Germans, Vincennes was occupied by the Communist troops, but it surrendered to the Versailles troops (28th May, 1871). Pop. 38,570.

Vincennes, a city of Indiana, United States, the county seat of Knox county, on the Wabash River; a railway centre on the Vandalia, Baltimore, & Ohio, and other railways. It is also an industrial centre. Founded in 1731 as a French fort, Vincennes was territorial capital between 1800 and 1813, and finally became a city in 1856. Pop. 17,200.

Vincent, John Jervis, Earl of St., British admiral, born 1734, died 1823. He entered the navy at an early age, and commanded the *Foudroyant* in the action between Admiral Keppel and the French fleet in July, 1778. In 1794 he commanded a squadron in the West Indies, and reduced Martinique, Guadeloupe, and St. Lucia. On the 14th Feb., 1797, in command of the Mediterranean squadron of fifteen sail, he defeated twenty-seven Spanish ships of the line off Cape St. Vincent, and was created a peer with the title of Baron Jervis and Earl of St. Vincent, and was granted a pension of £3000 a year. In 1799 he became admiral, in 1801 First Lord of the Admiralty, and in 1821 Admiral of the Fleet.

Vinci (vin′chē), Leonardo da, Italian painter, also distinguished as a sculptor, architect, civil and military engineer, and as a scientific inventor, was born at the village of Vinci, near Florence, in 1452, died in 1519 near Amboise, in France, where he is buried. He was the natural son of Pietro da Vinci, a Florentine notary, and as a boy displayed great talent in every direction, especially in drawing and modelling. His father placed him in the studio of Andrea Verrocchio, with whom he remained some years. The small *Annunciation* in the Louvre, which belongs to this period, shows his master's influence, but also a grace and delicacy of Leonardo's own. Other early works, *The Adoration of the Magi* (Uffizi, Florence) and *St. Jerome* (Vatican), show how soon he broke away from the contemporary outlook and methods. To an early period also belongs the *Virgin of the Rocks* (Louvre), of which the National Gallery picture is probably a later version partly executed by another hand. About 1482 Leonardo entered the service of Ludovico il Moro, Duke of Milan, who employed him in engineering as well as artistic work. In 1493 his model for an equestrian statue of Francesco Sforza was erected in the Castello at Milan; but no cast was ever made, and the model was afterwards destroyed, probably by the French. Between 1496 and 1498 he painted the famous *Last Supper* in the refectory of S. Maria della Grazia at Milan. The original has almost disappeared; but what remains, with copies and engravings, show it to have been one of the most impressive renderings of the subject ever achieved. One of the best copies is at Burlington House, London, by Marco d'Oggiono. After the occupation of Milan by Louis XII in 1499 Leonardo returned to Florence, where he painted the celebrated portrait of Mona Lisa del Giocondo, known as *La Gioconda*, now in the Louvre. In 1502 he was appointed chief engineer and architect of the Papal army, and, after visiting many of the fortified places in the Papal dominions, returned to Florence in 1503. Here he was commissioned by the Signoria to produce a cartoon for a battle-piece to decorate the Sala del Consiglio. This, known as the *Battle of Anghiari*, with a corresponding cartoon by Michelangelo, were described by Benvenuto Cellini as "the school of the world", so widespread was their influence. The fresco from the cartoon was begun but never completed; and its beginnings were covered by the later work of Vasari. In 1507 Leonardo was in Milan, and there probably painted *The Madonna and Child with St. Anne* (Louvre). In 1513 he visited Rome, and in 1516 accompanied Francis I to France, where he died. To this later part of his life no existing work can definitely be ascribed. Leonardo's writings include a *Trattato della Pittura*, first printed in 1651, which contains a mass of information on the principles and practice of painting, of which many subsequent writers have availed themselves. In 1797 some fragments of his mathematical writings were published in Paris, and created a profound sensation; and from 1880 to 1891 six volumes of miscellaneous manuscripts appeared, edited by M. Ravaisson. Leonardo's painting was based upon profound theoretical study and scientific knowledge. He worked slowly and produced comparatively little. Yet there is no artist of his time who does not owe something to him.—BIBLIOGRAPHY: J. P. Richter, *Leonardo da Vinci*; Jens Thüs, *Leonardo da Vinci*; Eugene Muntz, *Leonardo da Vinci*.

Vindhya, a mountain range of India, stretching east to west from the basin of the Ganges to Guzerat. It forms the northern boundary of the valley of the Nerbudda, and unites the northern extremities of the Eastern and Western Ghauts.

Vine, a well-known climbing shrub, type of the order Vitaceæ, which consists of climbing plants with woody stems, simple or compound leaves, peduncles sometimes changed into tendrils, small green flowers, and round berries. The species are found in both the Old and New Worlds, especially in Asia. The best-known and most useful of the order is the *Vitis vinifĕra*, the grape-vine, cultivated in the Old World from time immemorial, of which there are numerous varieties, distinguished by possessing lobed, sinuately-toothed, naked or downy leaves. Several species of vine are indigenous in North America, as the *Vitis Labrusca*, the wild vine or fox-grape; *V. cordifolia* or *riparia*, heart-leaved vine, river-side vine, or frost-grape; and *V. æstivālis*, the summer grape. The vine grows in every sort of soil, but that which is light and gravelly is best suited for the production of fine wines. It is a long-lived plant; indeed, in suitable climates the period of its existence is not known. It is propagated from seeds, layers, cuttings, grafting, and by inoculation, the first method being used for obtaining new varieties. See *Phylloxera*; *Oidium*; *Raisins*; *Currant*; *Wines and Spirits*.

Vinegar, the sour liquid formed by the acetic fermentation of dilute solutions of alcohol. The sour taste is due to the presence of acetic acid (some 5 per cent) obtained by the oxidation of the alcohol by the action of certain bacteria. In wine countries it is obtained from the acetous fermentation of inferior wines, but in Britain and elsewhere it is usually procured from an infusion of malt which has previously undergone the alcoholic fermentation. Vinegar is used in pharmacy for preparing many remedies, and externally in medicine, in the form of lotions. The use of vinegar as a condiment is universal. It is also used in making pickles.

Vinegar-plant, a common name of Fungi and bacteria which are capable of fermenting sugary or alcoholic solutions with formation of acetic acid.

Violet (Viŏla), the popular name given to the species of the genus Viŏla, which are favourite flowers in all northern and temperate climates, and many of them among the first to make their appearance in the spring. The corolla is composed of five unequal petals, the anterior being spurred; the roots are mostly perennial; the leaves are alternate and stipulate; and the flowers are penunculate. More than a hundred species are known. The greatest favourites are *Viŏla odorāta*, or common sweet violet, and *V. tricolor*, or heart's-ease, the former being especially esteemed for its fragrance. The well-known pansies so common as garden flowers are but varieties of *V. tricolor* produced by cultivation.

Violin and Violin-playing. Musical instruments which are made to sound by means of the plucking or bowing of strings have been in use in one form or another since prehistoric times, and authorities disagree regarding the origin of the violin.

It is certain, however, that the immediate predecessors of the various members of the violin class were the viols. These instruments first came into use in the fifteenth century, and remained in favour for about three hundred years. They were made in four principal sizes—the treble or discant viol, the tenor (*viola da braccio*), the bass (*viola da gamba*), and the double bass (*violone*); the number of strings was usually six, and the tuning was by fourths, with one third between the third and fourth strings. From these the model for the violin family was evolved by decreasing the depth, replacing the flat back of the viol by the curved or moulded back of the violin, and raising the shoulders of the body till they joined the neck at right angles, instead of flowing into it tangent-fashion, as was the case in the viol. The double-bass, alone of the violin family, has retained the flat back, the sloping shoulders, and the tuning in fourths of the viol tribe, while adopting the moulded belly of the violin. Finally the number of strings was reduced to four and the tuning altered to a series of fifths. Instruments on the new model were first made in Italy about the middle of the sixteenth century. Until recent times Gaspar Duiffoprugcar or Tieffenbrucker (1514–72) was regarded as the inventor of the violin, but latest researches tend to weaken his claim to that distinction.

Naturally the design and proportions of the perfect violin were not immediately discovered, and the subsequent changes were in matters of detail only. In the early days of Italian violin-making Brescia was the centre of the industry, and Gasparo da Salo and Maggini the principal makers, but it is with Cremona that all the greatest names are associated. Four generations of the Amati family (q.v.) worked there. Guarnieri and Stradivari, by variations in detail, brought the violin to a stage of perfection. Practically no change has been made in the instrument since their time, and the violin as we have it now is substantially the violin of 400 years ago.

Bows were certainly in use before the thirteenth century, and all early examples were clumsy. François Tourte (1747–1835), by many important improvements, produced a bow worthy of the perfected form of the violin. His name, therefore, is of as great importance as that of Stradivari himself.

Violin-playing.—The invention of the violin offered greatly increased opportunities to composers. Music for the viols had been written very much on vocal lines, as is shown by the phrase 'apt for voices or viols'. The history of violin-playing is really the history of violin-composition. Giovanni Gabrieli (1557–1613) was the first to show a decided instrumental sense in his writings, though he made only modest demands of the executant. Monteverde (1567–1643) made use in his music of *pizzicato* and the *tremolo*, and required definite gradations of tone from his players. Violin solos were first written early in the seventeenth century, one of them introducing the shake for the first time. Very soon varieties of bowing, double stopping, arpeggios, chords, octave passages, and frequent changes of position were introduced, leading to the earliest examples of violin sonatas, which consisted of slow and quick movements alternately. Corelli (1653–1713) was the greatest figure of the first period, summing up in his compositions all the best work of his predecessors. Tartini (1692–1770), great as performer, teacher, and composer, advanced the art of bowing. Paganini (1782–1840) finally demonstrated, in sensational fashion, the technical possibilities of the violin. At the present day the general standard of violin-playing is very high, the string sections of symphony orchestras, particularly in this country, being composed of thoroughly equipped players whose great technical proficiency in successfully meeting the serious demands of the modern composer is not always sufficiently realized.

Violoncello. This member of the violin family has been derived from the bass viol or *viola da gamba* by the introduction of the same changes which evolved the violin from the treble viol, but the name describes it as the diminutive form of the *violone*, the contrabass viol, which is practically the modern double bass. This relationship still holds, for the violoncello is an octave higher in pitch than the double-bass. The four strings are tuned in fifths, an octave below those of the viola, the lowest note being C below the bass stave. So far as can be discovered, Andreas Amati (1540–1600) was the first maker of the violoncello. The new instrument did not at once displace the viola da gamba. The special difficulties of fingering and bowing with regard to the instrument were systematically dealt with for the first time by J. L. Duport (1749–1819) in his *Essai sur le doigter du violoncelle et la conduite de l'archet.* The violoncello has a range of over three and a half octaves and a markedly characteristic and very beautiful quality of tone.

Viper, a name applied to various venomous Old World serpents belonging to the family Viperidæ, sub-order Viperinæ, and characterized, like other members of that section, by having no teeth in the upper jaw save the two hollow poison-fangs. The common viper or adder (*Vipera* or *Pelias berus*), the only venomous serpent which occurs in Britain, appears to be very local in its distribution. It is generally of a brownish-yellow colour, with zigzag markings and black triangular spots. Its bite is, as a rule, not fatal, but may induce pain, sickness, and fever. The food consists of frogs, mice, birds, eggs, &c. The viper is viviparous—retaining its eggs within the body till the young are hatched. Among other snakes denominated vipers are the African puff adder (*Bitis arietans*); horned viper or asp (*Cerastes cornutus*) of North-Eastern Africa, Arabia, and Palestine; and the daboia or Russell's viper (*Vipera russelli*), native to India, Ceylon, Burma, and Siam.

Virchow (fĕr′*h*ō), Rudolf, German scientist, born 1821, died in 1902. He studied medicine at Berlin, and early became famous as a lecturer on pathological anatomy at Berlin University. In 1849 he accepted a chair at Würzburg, where he remained seven years, returning to Berlin in the autumn of 1856 as professor in the university and director of the pathological institute attached to it. Virchow rendered immense service to medical science by his discoveries in regard to inflammation, ulceration, tuberculosis, and numerous other morbid processes of the human body, and has had great influence on the whole of modern medicine, including hospital reform and sanitary science. Elected to the Prussian Diet in 1862, he became one of Bismarck's most powerful opponents. Among his many important works is *Cellular Pathology.* Most of his medical works have been translated into English.

Virgil (Publius Vergilius Maro), the national poet of Rome, was born near Mantua on the 15th of Oct., 70 B.C., and died at Brundisium on the 21st of Sept., 19 B.C. The form Vergilius is supported by the ancient manuscripts and inscriptions in unbroken succession to the fourth century A.D., but for many centuries the name has been spelt with an 'i' in all modern languages (e.g. 'Virgilio' in Dante), so that it would be pedantic to write 'Vergil' in English. Virgil was almost certainly of Celtic extraction; the province of Italy in which he was born was only admitted to full Roman citizenship when he was twenty-one. His Celtic blood would account for the tenderness and melancholy of his writings. Virgil's father was, according to some accounts a potter, according to others the hired man of one Magus, an attendant on the magistrates. He married his master's daughter, and purchased woodlands and raised bees. Virgil remained at Cremona until he was fifteen, when he went to Milan and thence to Rome. He lost his parents in his early manhood; his father had previously gone blind. Among other studies he gave attention to medicine and in particular to mathematics. He had some intention of practising as a barrister, but only conducted one case in court, as he spoke slowly and with difficulty. He began to write poetry when he was still a boy, composing an epitaph on the master of a school of gladiators called Ballista. Then he wrote some of his minor poems, proceeding to the composition of the *Bucolics* or *Eclogues*, which he finished in three years. The *Georgics* took seven years and the *Æneid* twelve. When writing the *Georgics*, he dictated every day a large number of verses which he had composed in the morning, and spent the rest of the day in reducing them to a very small number. He used to say, with more wit than knowledge of natural history, that he licked his poem into shape, as a she-bear did her cubs. The *Æneid* was drafted first in prose, and divided into twelve books; Virgil then turned into verse one part after another, as fancy guided him. In order not to interrupt the flow of his inspiration he left some things unfinished, and buttressed others up with slight words, which, as he used to say, were put in like props, to support the structure until the solid columns should arrive. In 19 B.C., wishing to give the finishing touches to the *Æneid*, he determined to go away to Greece and Asia, and, after devoting three entire years to the task of improving his poem, to give up the rest of his life wholly to philosophy. He returned from Athens with Augustus, but caught near Megara a fever which was aggravated by the journey, and died at Brundisium. He was buried at Naples, on the road to Pozzuoli. In person, Virgil was tall and broad, with a dark complexion and a rustic appearance. His health was uncertain; he had stomach and throat troubles, sick headaches, and frequent hæmorrhages. He possessed nearly ten million sesterces given to him by his friends, and he had a house at Rome on the Esquiline, near the gardens of Mæcenas, although he usually lived in retirement in Campania and in Sicily. At Naples he was nicknamed 'The Maiden' (cf. Milton, who was known at Cambridge as 'The lady of Christ's'), on account of his modesty; and whenever he appeared in public in Rome he would take refuge in the nearest house, to avoid those who followed and pointed him out. This account of Virgil has hitherto followed the short biography which is almost certainly by Suetonius. To it we may add that Virgil owed his worldly success largely to his friendship with Mæcenas and with the emperor. Horace and Virgil were intimate and affectionate friends also; Horace mentions his friend eight times in his works, and accompanied him and Mæcenas on the journey to Brundisium (*Sat.* i, 5).

The pastoral poems, which are known indifferently as *Eclogues* or *Bucolics*, were published in 37 B.C. The collection consists of ten poems all more or less closely modelled on Theocritus (q.v.). There is an autobiographical element in some of these poems which has proved almost as baffling to commentators as the similar element in the *Sonnets* of Shakespeare. The fourth eclogue has attained a disproportionate celebrity because it was for long considered to be a prophecy of the coming of the Messiah. The sixth eclogue, which contains many reminiscences of Lucretius, is a good poem. The eighth is an imitation of the celebrated second idyll of Theocritus; the story has inartistically been given a happy ending. The remaining poems deal mainly with the commonplaces of pastoral poetry. Virgil's *Eclogues* are the least mature of his poems, but they show many examples of the exquisite finish which he could give to his lines. They set the standard for pastoral poetry for many centuries. Those who, like J. C. Scaliger, prefer them to the *Idylls* of Theocritus, might as well make a similar extravagant claim for Calpurnius Siculus, or the "good old Mantuan" whom Holofernes in *Love's Labour's Lost* so heartily commends. Despite their felicities of metre and language, the *Eclogues* are feeble and artificial poems, a mere echo of the work of a poet who excelled in this kind of writing. In them Virgil shows, like Sir Toby Belch, 'no respect of place, persons, nor time'. Sicily and Lombardy, Virgil's friends and Arcadian shepherds, the reign of Ptolemy Philadelphus and the reign of Augustus are all indiscriminately mixed together.

The *Georgics* is Virgil's most finished and most characteristic work, and is the most polished and perhaps the most famous didactic poem in the world. It was inspired by the *Works and Days* of Hesiod (q.v.). Hesiod, though an interesting and important poet, owes not a little of his charm to his *naïveté*, to his lack rather than to his possession of artistic skill. Virgil was above everything an artist, so he imitated Hesiod in a different fashion from that in which he imitated Theocritus. Virgil owed a debt also to Aratus, Cato, and Varro; but all that gives the poem its unique quality is his own. The first book deals with farming in general, the second with the growing of trees, the third with the rearing of cattle, and the fourth with bee-keeping. Virgil's object in writing the *Georgics*, however, was not to convey accurate information, but to glorify labour, and to turn the thoughts of men to the advantages which the country has over the city. It is probable that the poem was written in obedience to a wish of Mæcenas, expressed in order to further the emperor's agrarian policy; but it is no mere piece of propaganda, nor has it the appearance of having been written to order. It is filled with a lofty patriotism. It certainly helped to revive some of the simple tastes and sentiments of the olden time. The poem was written and revised with scrupulous care, at an average rate of less than a line a day. It owes its fame mainly to its finish and its lofty thought, but its message is not to be overlooked. That message is the same as that of *Candide*—"Il faut cultiver notre jardin".

The *Æneid* is the most important and most influential poem of Virgil's works, but there are reasons for believing that he undertook the composition of it with some reluctance. Suetonius says that he began to write of Roman legend, but, thinking himself unequal to the subject, turned to the *Bucolics*. Virgil hints at this incident in *Eclogue* vi, 3. The *Æneid* was a mirror, as it were, of both the poems of Homer, books i to vi resembling the *Odyssey*, and books vii to xii the *Iliad.* It treated Greek and Latin personages and affairs in common, and contained at the same time an account of the origin of the city of Rome and of Augustus, which was the poet's special aim. It was therefore an official poem, and Æneas has something of that sacrosanctity which belongs to a State employee. Before the poem was well begun Propertius hailed it as something greater than the *Iliad.* Virgil did not share his confidence or enthusiasm. He wanted to devote three years to polishing the poem, and requested his friend Varius to burn it should he die. On his death-bed he would himself have destroyed it; and when he was not allowed to do so, he made Varius and Tucca his literary executors, on condition that they should publish nothing which he himself would not have given to the world. Varius, however, published the *Æneid* at Augustus's request. Some parts of the *Æneid,* especially the battle-scenes, seem to have been written under the uncomfortable necessity of producing what should please the emperor. In spite of these defects, the *Æneid* is not only one of the most famous but also one of the noblest poems in the world. In the sixth book in particular Virgil has shown himself a real *vates,* the equal of Homer and of Dante. Besides being one of the world's great poets, Virgil is in a peculiar and intimate sense the national poet of Italy—as much so as Burns is the national poet of Scotland. He is so mainly on the strength of the *Æneid,* which, if not a success as a whole, contains his most majestic passages.

The minor poems assigned to Virgil consist of the *Catalepton,* fourteen small poems, in various metres, some of which are perhaps the work of his 'prentice hand; the *Culex,* an epyllion, probably by a contemporary admirer of Virgil; the *Ciris,* almost certainly not by Virgil; the *Moretum,* possibly genuine and an early exercise in composition; and the *Copa,* a poem so un-Virgilian in style that it probably was not attributed to Virgil without good reason.

Virgil has never lacked detractors, even from the earliest days. One Herennius made an anthology of his defects, one Perellius Fausta gathered together his pilferings. Modern times have produced a fresh body of hostile critics. The common charge against Virgil is that he is artificial—as if all poetry were not artificial to a greater or a less extent. His works repay close study; he that runs may not read them. They display perfection and purity; Virgil shows himself when at his best as a man of a higher type, not even a little lower than the angels. In the centuries following Virgil's death grammar became a religion and Virgil its high-priest—Musarum sacerdos. In the Dark Ages 'all learning fell under suspicion, till at length the very grammar itself gave to English the word gramarye'; by a similar change Virgil turned into a great magician—the Merlin of the Roman Empire. He was credited with universal knowledge and ability to do everything. His works were ransacked (as those of Shakespeare sometimes are), not for their wisdom, but for the encyclopedic information which they were supposed to contain. Mediæval legend which made Virgil a sorcerer is, however, less far astray than modern scientific criticism, which makes him a mere plagiary, just as the savage who worships the sun is in a more salutary frame of mind than the scientist who thinks that by means of the spectroscope he has plucked out the heart of the mystery of the solar system. Virgil himself used to say about his detractors: "Why don't my critics also attempt the same thefts? If they do they will realize that it is easier to filch his club from Hercules than a line from Homer." In the happy passage in which he speaks of the *curiosa felicitas* of Horace, Petronius calls Virgil "Roman Virgil". The same phrase is used in Tennyson's noble *Lines to Virgil,* written at the request of the Mantuans for the nineteenth centenary of the poet's death. This poem is the finest tribute in English to the

> Wielder of the stateliest measure ever moulded by the lips
> of man.

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Virginal. See *Pianoforte.*

Virginia, a state in the South Atlantic division of the United States. It has a considerable seaboard, deeply serrated by drowned river-valleys, backed by a large coastal plain (*Tidewater Virginia*), which merges westwards with the submontane (*Piedmont*) region, that is, in turn entirely swallowed up in the Blue Ridge. Behind the Blue Ridge is the Appalachian zone, with its *valley,* the Shenandoah Valley or Valley of Virginia, drained by the Shenandoah. Richmond is the state capital; other towns are Norfolk, Roanoke, Portsmouth, and Newport News. There are over 5000 miles of railway track, the chief lines being Seaboard Air, Atlantic Coast, Chesapeake & Ohio, and Southern. In 1920 not 2 per cent of the population was foreign-born; and of 30,800 (approximately) foreigners, about 3800 were English, 5400 (or nearly 18 per cent) Russian, and 2800 German. Other nationals were Irish and Scots. About 80 per cent of the total population is negro. Virginia is a great cotton-producing and manufacturing state, but the leading manufacture is tobacco. Pea-nuts are graded, roasted, and shelled, and iron, paper, pulp, glass, leather goods, &c., are made. There are valuable oyster and other fisheries. Minerals worked include coal, copper, granite, lead, gold, and gypsum, and there are many mineral springs in the Appalachian region, some of them thermal (as at Hot Springs, 110° F., and Healing Springs, 90° F.). Education is free and compulsory between the ages of eight and twelve years; the colour bar is rigid, and white children are strictly segregated from black. There are schools of theology, law, medicine, dentistry, &c., a State university, and many colleges. Area, 42,627 sq. miles (2365 sq. miles being water); pop. 2,310,000.

Virginia was one of the original thirteen states of the Union. For local government purposes there are 100 counties. The central government or General Assembly is bicameral, comprising a Senate (between 33 and 40 members, elected for four years) and a House of Delegates (100 members, elected biennially). Two Senators and 10 Representatives are sent to Congress.—Bibliography: T. J. Wertenbaker, *Virginia under the Stuarts*; J. E. Cooke, *Virginia: a History of the People* (American Commonwealths Series).

Virginian Creeper, the *Parthenocissus quinquefolia*, a climbing plant, native to North America, used as an ornamental covering for walls, &c., and sometimes called *American Ivy*. Its leaves turn a bright red in the autumn.

Virgin Islands, an archipelago of the West Indies, divided between Great Britain and the United States; area, 465 sq. miles.

British.—Thirty islands are British; area, 58 sq. miles; pop. 5082. Tortola, the largest, contains Road Town (pop. 463), the only town and seaport. Other islands are Virgin Gorda, Anegada, and Jost van Dyke. The group forms one of the five Presidencies of the Leeward Islands, and is governed by a nominated Executive Council. Cotton and sugar are the chief products. Sombrero, an outlying island maintained as a lighthouse, is administered by the Presidency.

United States.—Over 100 islands are American; area, 132 sq. miles; pop. 26,051. St. Croix (84 sq. miles, pop. 14,901; towns, Christiansted, pop. 4580, Frederiksted, pop. 3200), St. Thomas (28 sq. miles, pop. 10,191; town, St. Thomas, pop. 7900), and St. John (20 sq. miles, pop. 959) are the principal islands. In 1916 the Danish West Indies were purchased by the United States, and government was organized on a municipal basis, a Colonial Council governing each Municipality under the Governor. There are two Municipalities: (1) St. Croix (Council of 18), (2) St. Thomas and St. John (Council of 15). The Governor has a Cabinet of six portfolios.

Virton, a town of Belgium, in the south of the province of Luxembourg. It is an educational centre, with a tanning industry and a trade in wood. In 1914 (European War) Virton was the scene of desperate Franco-German engagements. Pop. 3000.

Virtual Work, or Virtual Velocities, Principle of. This refers to a method of solving problems in the statics of connected systems. A *virtual displacement* is any small displacement consistent with the mechanical connections. The *virtual work* corresponding to such a displacement is the work done by the forces actually applied to the body or system while the displacement takes place, each force remaining unaltered in direction and magnitude. The *principle of virtual work* asserts that if a system is in equilibrium under any forces, the algebraic sum of the amounts of virtual work done by all the forces must be zero (more strictly, must be of an order of smallness higher than that of the small displacement). A simple example of the application of the method is furnished by the lever, where the work done by the 'effort' is equal and opposite in sign to that done by the 'load' when a small rotation about the fulcrum takes place.

The *principle* was first studied by the French mathematicians. Lagrange used it as the basis of his great treatise *Mécanique Analytique*. Thomson (Kelvin) and Tait gave a proof based on the principle of conservation of energy. Since D'Alembert's principle makes the equations of motion of a system depend on the principle of statical equilibrium, the application of the principle of virtual work extends to kinetics. This application led to Lagrange's generalized methods in dynamics. A full account of 'virtual work' is given in E. J. Routh's *Analytical Statics*.

Viscacha (vis-kä′chȧ; *Lagostŏmus trichodactylus*), a rodent mammal of South America, allied to the chinchilla, about 2 feet long and stoutly built, with a short tail, inhabiting the Argentine pampas, and living in burrows.

Viscosity, a kind of internal friction opposing relative shearing motion of the parts of a body. Viscosity is shown in a certain degree by every sort of material, but it is most important in liquids. Its intensity is measured by the *coefficient of viscosity* (see *Hydrodynamics*). The property is quite distinct from elasticity of shape, in which fluids are entirely lacking. The resistance of an elastic body to change of shape depends on the *amount* of the change, whereas viscous resistance depends on the *rate* at which the change takes place. The coefficient of viscosity of a liquid is usually determined by measuring the volume of liquid which flows through a capillary tube, and applying Poiseuille's formula $\pi Pr^4t/8lV$ for the coefficient, where P is the difference of pressure between the two ends of the tube, r its radius, l its length, and V the volume of liquid delivered in time t. The coefficient depends to a marked extent upon the temperature, decreasing rapidly, as a rule, as the temperature rises. The following are some values in C.G.S. units: at 20° C., ether 0·003, water 0·01, glycerine 8·5; at 8° C., shoemaker's wax $4{\cdot}7 \times 10^6$; at 15° C., air 181×10^{-6}.

Viscount (vī'kount), a title of nobility next in rank to that of earl, and immediately above that of baron. It is the most recently established English title, having been first conferred by letters patent on John, Lord Beaumont, by Henry VI in 1440. The title is frequently attached to an earldom as a second title, and is given by courtesy to the eldest son of the earl.

Vishnu (the Preserver), the second god of the Hindu triad, but considered by his worshippers as the greatest. He is always becoming incarnate to oppose the power of the demons, to restore the authority of the gods and effect a beneficial change in the government of the universe. His descents are called *avatars*, or incarnations, and are regarded as innumerable, although ten special avatars are given. He is generally represented as having four arms, and as riding on the Garuda, a being half man and half bird.—Cf. W. J. Wilkins, *Hindu Mythology*.

Visibility, the state of the atmosphere in regard to the ease with which objects at a distance can be discerned. Visibility is impaired by the presence in the air of foreign particles, which both intercept light rays and produce a general scattering or diffusion of light, tending to hinder the discrimination of light and shade. The foreign matter partly consists of molecules of hygroscopic substances. Though of almost perfect transparency when the air is dry, under humid conditions they attract water and diminish the visibility. Other foreign particles are solid and relatively heavy. These also furnish nuclei for the condensation of vapour, and thus dense fogs are often produced in cities from the numerous soot and dust particles. Even without attracting aqueous vapour, dust particles sometimes cause dense obscuration from their mere abundance and opacity, as in tropical duststorms. In certain unstable types of pressure distribution, such as 'wedges' and straight isobars, the weather may be temporarily fine, with dry and transparent air, a condition soon to give place to a barometric depression and rainfall. On this account marked visibility, or 'distant hills seeming nigh', although in general indicating present dryness of the atmosphere, is often quoted as foreboding the approach of rain.

Vision. See *Eye*; *Lens*; *Light*.

Vis'tula (Pol. *Wisła*; Ger. *Weichsel*), a river of Poland, rising in the Carpathians, and emptying into the Gulf of Danzig after a course of about 650 miles. Its delta is within the territory of the City of Dantzig (q.v.). The actual outlet of the Vistula is an artificial one which was cut in 1895 between Einlage and Schiewenhorst. The Elbing Vistula (16 miles long; Elbing to Frisches Haff) and the Dantzig branch or 'Dead Vistula' are used as canals, and the Nogat (see *Prussia, East*) is controlled from the head of the delta at Pieckel (32 miles from the sea). The fall of the Vistula is only 1 in 5625 above Pieckel and 1 in 5886 on the delta. The name adopted here and generally used in English is the Latin one. See *Poland*.

Vitamines. A diet which supplies the organism with an adequate amount of proteins, carbohydrates, and fats may yet be deficient in power to maintain health in the adult or promote growth in the young. This defect is at present held to be due to the absence or insufficiency of certain substances found in minute proportions in most uncooked food-materials, particularly in milk-fat and green vegetables. Such substances have been named *vitamines* or *accessory food factors*, since their intimate chemical structure is still unknown. At least three different members of this class have so far been distinguished: *fat-soluble A*, essential for growth; *water-soluble B*, essential both for growth and protection against beri-beri; and an *antiscorbutic factor*.

The incidence of scurvy, for centuries a common epidemic disease amongst Europeans and North Americans resident in climates where the supply of fruits and vegetables was restricted to a short season of the year, and also among sailors undertaking long voyages, has been reduced to almost nil by the more extensive use of fresh vegetables, especially potatoes, and the inclusion of lemon-juice in the ship's rations. The disease of beri-beri, a type of neuritis prevalent among Oriental races, has been shown to be associated with the too exclusive use of rice as a dietary constituent. Only polished rice is deficient, and a similar condition, experimentally produced in animals, may be relieved by the addition of the polishings. Attempts to investigate the chemical nature of this antineuritic vitamine have met with some success.

For proper growth in animals the presence of at least two vitamines is essential: one, fat-soluble A, found mainly in milk, eggs, and the green leaves of certain plants; and the other, water-soluble B, particularly abundant in meat, potatoes, and legumes; the latter is probably identical with the antineuritic vitamine. Fat-soluble A has recently received much attention in connection with *rickets* (q.v.) in children. In assessing the value of vitamines as therapeutic agents, it must always be remembered that, even allowing that such substances as vitamines exist as chemical entities (which is doubted by some authorities), it is only under exceptional dietary conditions that any of them is present in insufficient amount.

Vitebsk, a government of the Russian Republic, bordering the Latvian frontier and the Polish Corridor. Area, 15,591 sq. miles (1923); pop. (estimated), 1,350,000. It is generally hilly, and in the depressions lie innumerable lakes (Osveya, Nescherda, &c.) and extensive marshes. The Dvina, connected by the Berezina Canal with the Dnieper, is the chief river. Agriculturally the government is poorly developed, but cereals and flax are produced. Manufacturing industries are at their nadir. Vitebsk is the capital; other towns are Polotsk (q.v.), Sebezh (pop. 5000; on Sebezh Lake: the frontier station on the Moscow-Windau & Riga Railway), Nevel, and Lepel (9000; on Lepel Lake). Originally part of the principality of Polotsk, Vitebsk became a separate principality, was annexed to Lithuania in 1320, and subsequently merged in Poland, from which it passed to Russia during the first partition (1772).

Vitebsk, a city of Russia, capital of the government of Vitebsk, on the Dvina; served by the trunk lines from Petrograd and Riga. It is largely Jewish. There are flax-spinning industries, and a brisk trade is carried on. The mean annual temperature is 40° F. (January mean, 16° F.; July mean, 64·5° F.). Pop. 70,000.

Vitellius, Aulus, a Roman emperor, remarkable only for his gluttony. He was appointed commander of the legions in Lower Germany by Galba, and on the death of the latter he was proclaimed emperor by his troops (26th Jan., A.D. 69). Six months later Vespasian was called to the throne, and Vitellius was deposed and executed (22nd Dec., 69).

Viter'bo, a city of Italy, in the province of Rome. It has an old Romanesque cathedral containing the tombs of several Popes. Pop. 17,500.

Vito'ria, or **Vittoria,** a city of Spain, capital of the province of Alava; a junction for Salinas de Leniz (12 miles), on the trunk line Irun-Madrid. Here, on 21st June, 1813, Wellington defeated the French under King Joseph and Marshal Jourdan. Pop. (1918), 34,115.

Vitrified Forts, the name given to certain prehistoric hill-fortresses found in Scotland, Ireland, and the continent of Europe, and formed of stones heaped together. The materials of which they are constructed are perfectly or partially vitrified or transformed into a kind of glass by the action of heat. It is now generally believed that the vitrifaction was intentional, being effected by means of piled-up fuel.

Vitruvius Pollio, Marcus, a celebrated Latin writer on architecture, who flourished in the time of Julius Cæsar and Augustus, and wrote his work *De Architectura* probably about 13 B.C. This treatise is valuable as a compendium of those of numerous Greek architects.

Vitry-le-François, a town of France, in the department of Marne, on the Marne; an important junction on the main line Paris-Sarrebourg, for Chaumont (63 miles; on Paris-Basel line), and minor branches to Sezanne (44 miles) and Bar-sur-Aube (40 miles). It is also the starting-point of the Marne-Rhine and Marne-Saône canals, has a Chamber of Agriculture, manufactures cement, carries on iron- and bell-founding and tanning, and has a trade in cereals, wine, wood, and wool. Pop. 9000.

Vittoria, a town of Sicily, in the province of Syracuse; served by the railway from Syracuse to Licata. It has the largest Sicilian wine-market, and has oil and wine industries. The name honours the son of Vittoria Colonna, who founded the place in 1605. Pop. 31,000.

Vittorio, a town of Venetia, North Italy, in the province of Treviso; served by a branch railway (9 miles) to Conegliano (on the trunk line Venice-Tarvisio). It is a sericultural centre which was formed by the amalgamation of the two towns Ceneda and Serravalle, the present name being adopted in honour of Victor Emmanuel I. Pop. 9000.

Viver'ridæ, a family of carnivorous mammals, including civet-cats, genets, and allied forms.

Vivianite, a translucent indigo-blue or bluish-white mineral, occurring in blade-like crystals in association with iron sulphides in veins, and consisting of hydrous iron phosphate. It also forms blue powdery crusts on the surfaces of bones entombed in bogs, as a result of reaction between calcium phosphate and salts of iron. The iron phosphate widely diffused in soils is probably vivianite.

Viviparous Plants, those the seeds of which germinate while still attached to the parent plant, a condition seen in its typical form in Rhizophora and other mangroves. This is true viviparity, but the term is more often applied to that form of vegetative propagation in which flowers are replaced by bulbils, a common feature in alpine plants.

Vivisection, the name given by its opponents to operation upon living animals in the course of scientific research. In Great Britain, excepting the Channel Islands and the Isle of Man, vivisection is illegal unless conducted under licence from the Home Office. Licences are granted to individual experimenters for the conduct of experiments at specified places which are liable to visitation and inspection by Government officials. No licence, however, covers every variety of experiment or species of animal, so that, in addition to his licence, an experimenter must possess himself of one or more of several certificates if he wishes to do more than operate under a general anæsthetic without allowing the animal to recover. The Act of Parliament is involved and vexatious; but experimenters no longer urge or desire its amendment, since its provisions once understood give fair liberty in practice. Supported in this country by a few publicists of ability and popularity, the anti-vivisection movement advanced to a legislative success still unattained in Continental countries and America. There is much that is anomalous in the legal situation in Great Britain.

Vizagapatam′, a town of British India, Madras Presidency, at the entrance of the Veragatam into the Bay of Bengal. It is a military station, and has a good harbour. Pop. 43,564.

Vizier (Ar. *wazir*, a bearer of burdens), a title given to high political officers in the Turkish Empire and other Mahommedan states. In Turkey the title is given to the heads of the various ministerial departments into which the Divan or Ministerial Council is divided. The President of the Divan, or Prime Minister, is known as Grand Vizier, *vizier-azam* or *sadr-azam*.

Vlaar′dingen, a town of the Netherlands, province of South Holland, on the New Maas, a seat of the Dutch herring-fishery. Pop. 23,000.

Vladikav′kaz, a town of the North Caucasian (Mountain) Republic, the chief town of Ciscaucasia and the capital of the imperial government of Terek, on the Terek. It is an agricultural centre, and has tanning, soap- and candle-making, brewing, and other industries, as well as a brisk transit trade over the Caucasus. Horses are raised in the district, and zinc-blende is worked. The altitude is 2345 feet, and the mean annual temperature 47·7° F. (January mean, 23° F.; July mean, 69° F.). April to September is the wettest period. Pop. about 60,000.

Vladimir (vlȧd-ē′mēr), a former government of Russia. Area, 18,800 sq. miles; pop. 1,942,000. It is drained by the Oka and its tributary the Kliasma. There are important manufactures of linens and woollens, and several blast-furnaces.

Vladimir, one of the oldest towns in Russia. It has a cathedral, a theological seminary, considerable manufactures, and a trade in fruit. During the thirteenth century it rivalled Moscow in importance, but began to decay in the following century. Pop. 39,000.

Vladivostok, the chief port of the Far Eastern Republic of Siberia, formerly the chief Russian naval port in the Pacific; the terminal of the Usuri and Manchurian Railways, running respectively to Khabarovsk and Harbin. A modern town, Vladivostok was founded in 1860, and is an ice-free port among afforested hills on Peter the Great Gulf. The mean annual temperature is 40° F. (January, 5°; August, 69·4°), rainfall 14·7 inches (mainly in August).

Voi, a place in Kenya Colony, the junction for Moshi, on the Mombasa-Nairobi railway. Moshi is in Tanganyika Territory and on the Arusha-Tanga railway.

Voice. See *Singing*; *Larynx*.

Volapük (vō′la-pük), the name given to a universal language invented in 1879 by Johann Martin Schleyer (born 1837), of Constance, after twenty years' labour. The name means 'world-speech', being based on English *world* and *speak*, and a number of the vocables are modified English words. In structure the language is simple and extremely regular, and the orthography is entirely phonetic, the words being pronounced as they are written, and vice versa. The vocabulary consists of about 15,000 words. The study of Volapük for a time made rapid progress; periodicals were written in it, and associations were devoted to spreading it; but it declined after 1890.

Volcanoes, in a popular sense, conical hills or mountains composed of material (volcanic ashes and lava) brought up by igneous forces from the interior of the earth through a pipe or vent. The orifice is a cup-shaped hollow called the crater, which is sometimes due to explosion, and sometimes to the building of a ring round the vent by the products brought up from below. A volcanic eruption generally commences with the discharge of immense quantities of gases. This is followed by the ejection of "ashes" and hot fragments of rock. Lastly there is a flood of molten rock or lava. Volcanoes which show such outbursts more or less frequently are called *active* volcanoes; those which are known to have been active in historic times, but have long been quiescent, are called *dormant* or sleeping volcanoes; and those which present all the phenomena of volcanoes, but which have shown no activity in historic times, are called *extinct* or dead volcanoes. The mud volcanoes or *salses* of New Zealand, Burma, and elsewhere (conical hills of slowly flowing mud); the *fumaroles* (fissures from which steam issues); the *solfataras* (holes from which sulphurous fumes proceed) of Italy, &c.; the geysers and hot springs of Iceland, New Zealand, the Yellowstone Park, &c., are signs of weak or decreasing volcanic activity in the special districts in which they occur. Volcanoes may occur as isolated conical mountains, such as Vesuvius, Etna, or the Peak of Teneriffe. They also form various groups or systems of mountains. One remarkable fact in the distribution of volcanoes is their proximity to the sea, for out of 323 active volcanoes enumerated by Fuchs, almost all are within a short distance at least of the ocean. This is probably due to their being situated on lines of earth-movement, such as mark continental margins or the floors of sinking areas. There are certain regions over the whole of which active volcanic vents are distributed at intervals. Of these great regions that of the Andes is one of the best defined. An almost uninterrupted line of volcanoes stretches from the 46th degree of s. lat. in Chile to the north of Mexico, including Tunguragua, Cotopaxi, Antisana, Pichincha, Orizaba, Popocatepetl, Jorullo, &c. Another continuous line of volcanic action commences in the north of Alaska, passes through the Aleutian Isles over to Kamchatka in North-Eastern Asia, then proceeds southward without interruption through a space of between 60° and 70° of latitude to the Moluccas. It includes the Kurile, Japanese, and Philippine Islands, traverses Java, Sumatra, Borneo, Celebes, and New Guinea, and extends to various parts of the Polynesian Archipelago and New Zealand. In the Old World the volcanic region extends from the Caspian Sea to the Azores, embracing the greater part of the Mediterranean and especially some of its islands. Here volcanic action is most prominently visible in Vesuvius, Etna, and the Lipari Islands. Among disconnected volcanic groups may be mentioned Iceland (Mount Hecla, in particular), the Hawaiian Islands, Réunion or Bourbon, and Martinique and St. Vincent, in the West Indies, where an outburst in 1902 caused most lamentable destruction of life and property (see *Vesuvius*; *Etna*; *Hecla*; *Krakatoa*; &c.). Submarine volcanoes have left numerous traces among stratified rocks, but such as are active at the present day are inaccessible. In the nineteenth century several instances of the rise and disappearance of islands owing to volcanic action have been observed. Various theories have been proposed to account for the immediate cause of volcanic action. It is now generally accepted that it is produced by internal heat at a certain depth beneath the surface of the earth, and the evolution of a great body of elastic vapour, mostly steam, expanding and seeking to escape where the least amount of resistance is presented, and manifesting itself in the explosions that accompany an eruption, or in the upheaval of rocks and the production of earthquakes. While the molten contents of an igneous cauldron solidify in the earth, sufficient gas may be given off to shatter overlying rocks and clear a passage for eruption. See *Earth*; *Geysers*; *Earthquakes*; &c.

Vole (Arvicŏla or Microtus), a genus of rodents closely allied to the rats and mice, and included in that family. There is a short hairy tail, and the crowns of the back teeth possess grinding surfaces with triangular projections. Some are terrestrial, others aquatic. The common vole of Britain (*A. agrestis*), the meadow-mouse, or short-tailed field-mouse, is injurious to young plantations and pastures, sometimes appearing in immense multitudes. It is reddish-brown above and grey below. The water-vole (*A. amphibius*) or water-rat is much larger, and swims well though its feet are not webbed. It is of a pale- or chestnut-brown, tinted with grey. A black variety of the water-vole is common in Britain. There are many other species of voles in the Old and the New World.

Field Vole

Volga, a river in Russia, the longest in Europe; rising in a small lake in the east of the Valdai Hills, and falling into the Caspian Sea by about seventy mouths, near Astrakhan, after a total estimated course of 2400 miles. Its basin is estimated at from 500,000 to 700,000 sq. miles. It flows generally south-east past Tver, Yaroslav, Kostroma, and Nijni-Novgorod to Kazan, thence south past Simbirsk and Saratov, and proceeds south-east from Sarepta to the Caspian. Its chief tributaries are the Kama on the left bank and the Oka on the right. It is navigable by barges from its source, and communicates with the Black, Baltic, and Polar Seas by a series of canals. Its banks are fertile and well-wooded, and its waters abound in fish, particularly sturgeon, carp, and pike of extraordinary size.

Volhyn'ia, a former government in South-West Russia. Area, 27,800 sq. miles; pop. 4,000,000. In the region all kinds of grain, but particularly wheat, are produced, and fine breeds of cattle and horses are reared. The hills in the south are rich in iron, and there are considerable manufactures.—The new government of Volhynia forms a division of Ukraine. Area, 12,021 sq. miles; pop. 1,404,769.

Volog'da, a former government in North-East Russia; area, 155,500 sq. miles. Its forests furnish quantities of timber and charcoal. Pop. 1,679,000. The capital is Vologda, on a river of the same name, 35 miles E.S.E. of Petrograd. Pop. 39,000.

Volos, a town and seaport of Greece, at the head of the Gulf of Volos; served by the Thessalian Railway to Larissa and Kalabaka. It is the outlet for the cattle of Thessaly, which are exported to the Piræus, and for the chrome ore and other minerals of the region. Salt is worked in the vicinity. Pop. 30,100.

Volsci (vol′sī), an ancient Italian tribe who dwelt in Latium, on both sides of the River Liris (Garigliano). Their principal city was Corioli, from which Coriolanus derived his surname. After having several times endangered the Roman state they were conquered, and disappeared from history (383 B.C.).

Volt, the practical unit of electromotive force or electrical pressure. It is defined in relationship to the unit of current (ampere) and unit of resistance (ohm), both of which admit of exact definition in terms of physical dimensions and actions (see *Electrolysis*; *Ohm*); viz. the volt is that electrical pressure which would cause the flow of one ampere through a resistance of one ohm. The absolute electromagnetic, or C.G.S., unit of pressure is the difference of potential between the ends of a straight conductor 1 cm. long which moves at the rate of 1 cm. per second in a magnetic field of unit strength, the field, direction of motion, and length of the conductor being mutually at right angles. From this the definitions of the absolute C.G.S. units of current and resistance are obtained by using Joule's Law of Heating (see *Electricity*, paragraph on *Effects of an Electric Current*) and Ohm's Law in their simplest forms. Another method of defining these absolute units is to begin with the absolute unit of current (defined in *Electromagnetism*) and again use Joule's and Ohm's Laws to derive the other two units. The ampere, volt, and ohm are, respectively, $\frac{1}{10}$, 10^8, and 10^9 of the absolute units.

Volta, Alessandro, Italian physicist, born at Como in 1745, and died there in 1827. Two treatises, published in 1769 and 1771, in which he gave a description of a new electrical machine, laid the foundation of his fame. He was successively professor of physics at the gymnasium in Como and in the University of Pavia, where he invented the electrophorus and electroscope. He also devised several other electrical appliances, and in 1800 the voltaic pile (q.v.).

Volta, a river of West Africa formed by the union of the Black Volta and White Volta, and flowing generally south-east to the Bight of Benin, to which it disembogues below Adda (or Ada). The mouth is obstructed by a bar. The Black Volta rises in the Upper Volta Colony (French), flows north-east to near Kintampo, then south-east to cut through the hill range upon which it rises. It formerly joined the Niger. The White Volta rises in Upper Volta Colony, and is joined by the Red Volta. Rising in the same colony, the Oti forms the chief tributary of the united stream. Both Oti and Volta fisheries are important. Nearly the whole of the Gold Coast Colony and its hinterland belongs to the drainage basin of the Volta system.

Volta Effect, or Contact E.M.F., an electrical effect observed by Volta, in which two metals, having been placed in contact, and then separated, are found to be at different electrical potentials, the potential difference being known as contact E.M.F. Metals can be arranged in a series such that any metal is positive to the next metal in the series, e.g. zinc, lead, tin, iron, copper, platinum, carbon, the zinc being electropositive to lead, lead positive to copper, &c. According to Volta, the potential difference between two metals was caused by their contact alone, but this explanation has not been found sufficient. For instance, metals boiled in mineral oil at a high temperature exhibit no potential difference on contact. Further, it has been shown that the order of the metals in the contact series when air is the surrounding medium is also the order of their tendency to combine with oxygen. It is therefore considered probable that when two metals are brought into contact, their electrical potentials are equalized by conduction, but that they are then at different potentials from the films of air which are in contact with them.

Voltaic Cell, a device for the direct transformation of chemical into electrical energy. In its simplest form it consists of two plates of different conducting materials, such as zinc and copper, set up in a jar containing an electrolyte, e.g. dilute sulphuric acid. If the plates be joined outside the cell by a conducting wire, an electric current flows round the circuit, its direction being from zinc to copper within the liquid. During the passage of the current, zinc is dissolved, and hydrogen appears at the copper plate, the chemical action being represented by the equation $Zn + H_2SO_4 = ZnSO_4 + H_2$. The hydrogen remains on the copper, and reduces the electromotive force of the cell—an effect known as *polarization*, which makes this simple cell of little practical use. The most effective method of getting rid of polarization is to arrange so that a harmless ion, instead of hydrogen, is deposited on the copper plate. This is what is done in the Daniell's cell (q.v.). In the Leclanché cell a solid depolarizer is used. In this cell the electrolyte is a solution of ammonium chloride, in which a zinc rod is set; the copper plate of the simple cell already described is replaced by a carbon rod, round which manganese peroxide is packed in a porous container. The Cl ion from

NH_4Cl attacks the zinc, and the NH_4 ion is split up into NH_3 and hydrogen. The hydrogen goes to reduce the MnO_2, and, if the cell is only used intermittently, as in electric bell work, there is little polarization. See *Bunsen Battery*; *Electric Battery*; *Electricity*; *Electrolysis*; *Electromotive Force*; *Ionization*.

Voltaic Pile, Volta's arrangement for producing a current of electricity, consisting of a pile of alternate discs of two dissimilar metals, as copper and zinc, zinc and silver, zinc and platinum, separated by pieces of flannel or pasteboard moistened with salt water or with water acidulated with sulphuric acid.

Voltaire, François Marie Arouet de, French writer, born at Paris 21st Nov., 1694, died there 30th May, 1778. His father was François Arouet, a notary, and he was destined for the legal profession, but abandoned the law for letters. In 1718 a tragedy named *Œdipe* was brought out by him, and was a great success. It is said that this play was finished, and that two cantos of his epic the *Henriade* were written in the Bastille, where he was confined from May, 1717, to April, 1718, for writing certain satirical verses on the regent. He now became a fashionable poet and resided mainly at Paris, leading a life of gaiety and pleasure in the society of the great. It was about the beginning of this period that he adopted the name of Voltaire. In 1726 he was again imprisoned in the Bastille for sending a challenge to the Chevalier Rohan, by whom he had been grossly insulted. He was liberated within a month, and came to England on the invitation of Lord Bolingbroke. Here he resided till 1729 in friendship with the leading deists, and acquired some knowledge of English literature. His *Henriade* was completed and published by subscription in England. After his return to France he lived chiefly at Paris till 1734. From 1734 to 1749 he resided with the Marchioness de Châtelet at Cirey, in Lorraine. She died in 1749, and Voltaire then accepted the oft-repeated invitations of Frederick the Great to come and live at his court at Potsdam. Here he was received with great honour, but a series of disagreements with the king ended in Voltaire's retirement from the Prussian court in 1753. He then resided for a short time at Strasburg, Colmar, and Lyons, removing at the end of 1754 to Geneva. For almost the whole of the remainder of his life he lived in Switzerland, or close to its borders. In 1760 or 1761 he fixed his residence with his niece, Madame Denis, at Ferney, where he received a constant succession of distinguished visitors, and maintained a correspondence which included in its range most of the crowned heads of Europe. In Feb., 1778, he went to Paris, where he was received with enthusiasm by all classes. But the excitement of the occasion hastened his death. His works embrace almost every branch of literature: poetry, the drama, romance, history, philosophy, and even science. Hatred of fanaticism and superstition was his chief characteristic, and nearly all his works are strongly animated by a spirit of hostility to the priests and the religion they represented. He upheld theism, however, with as much zeal as he denounced Christianity and priestcraft. Voltaire's literary fame chiefly rests on his philosophical novels: *Zadig*, *Candide*, *L'Ingénu*, &c.; his histories: *Siècle de Louis XIV*, *Histoire de Charles XII*; his correspondence; and more than all, perhaps, on his poetical epistles, satires, and occasional light poems, which all exhibit wit, gaiety, vivacity, and grace. Several of his tragedies, such as *Zaïre*, *Alzire*, *Merope*, *Mahomet*, had great success in their day, but are not assigned a high place in French literature. His comedies, the best of which is *L'Enfant Prodigue*, were less successful. His *Henriade*, an epic poem, had great success, and exercised a powerful influence when it first appeared.—BIBLIOGRAPHY: Lord Morley, *Voltaire*; J. Parton, *Voltaire*; Sir E. B. Hamley, *Voltaire* (Foreign Classics for English Readers Series).

Volterra (ancient **Volaterræ**), a town of Italy, in the province of Pisa; connected with the Cecina-Pisa Railway by branch line to Cecina (19 miles). It was anciently one of the twelve principal cities of Etruria, and possesses a museum rich in Etruscan antiquities. Pop. 16,784.

Voltmeter. See *Electrical Measuring Instruments*; *Ammeter*.

Voltur'no, a river of Italy, rising in the province of Campobasso, flows south-east to its junction with the Calore, and then west past Capua into the Mediterranean, 20 miles south-east of Gaeta. Length, 90 miles.

Volunteers, originally certain bodies or companies of men enlisted in the eighteenth century to serve with the Militia (q.v.). They were so called because they enlisted of their own free will, and so saved a particular locality from enforcement of the Militia Ballot Act; but they had no separate existence, and were merged in the Militia. In 1794 an Act was passed recognizing various Volunteer companies which had been raised in expectation of a French invasion, and making provision for their pay and discipline if and when called out. Early in the next century a very large number of Volunteer corps, both yeomanry (q.v.), infantry, and artillery, were raised, and some 400,000 men are said to have been enrolled; but in many cases these corps were little better than rifle clubs, and Fortescue estimates that not more than 60,000 could have taken the field. 'Fencibles', as some corps were named, are generally classed as 'Volunteers', but in vol. iv of his *History of the*

British Army Fortescue says distinctly that these were "regular troops enlisted for service at home and for the duration of the war only". After 1814 the Volunteer movement languished, and Volunteers almost ceased to exist till a new scare of war with France in 1859 again brought them into being, and for the next fifty or sixty years various Acts of Parliament dealing with Volunteer organization were passed. When the Territorial grouping of the Regular army became a *fait accompli* in the 'seventies of last century, all Volunteer units were affiliated with the county regiments; then, in 1907–8, with the passing of the Territorial and Reserve Force Act of 1907, all existing Volunteers became absorbed into the Territorial Force (now Territorial Army). See *Territorials*.

Volvox, a remarkable genus of freshwater Green Algæ, group Volvocales. The plant consists of a small sphere of translucent jelly, embedded in which are a number of minute green cells (over 20,000 in the largest species, *V. globator*). Each cell has all the features of an individual of Chlamydomonas (q.v.); by the combined action of the numerous pairs of flagella the whole structure travels through the water with a characteristic rolling motion. A living Volvox is one of the most attractive of microscopic objects.

Vondel, Joost van den, Dutch poet and dramatist, born in 1587, died in 1659. His works include metrical versions of the *Psalms*, of Virgil, and of Ovid, together with satires and tragedies. Of the latter *Palamedes*, the *Conquest of Amsterdam*, and *Lucifer* are considered the masterpieces of Dutch tragedy.

Vorarlberg, the westernmost province of Austria, comprising three districts as follows:

Districts.	Area, sq. Miles.
Bludenz	500·5
Bregenz	347·5
Feldkirch	156·6
Area	1004·6

In 1920 the population was 133,212 (mainly German-speaking Roman Catholics). Bregenz (pop. 12,100) is the capital, but Dornbirn (pop. 1920, 13,800) is the commercial capital. Other towns are Bludenz (6000), on the Ill, and Feldkirch (5000). All these places are engaged in the textile industry, and Bregenz, Bludenz, and Feldkirch are on the railway Lindau-Innsbruck-Salzburg (see *Arlberg*; *Tirol*). Other lines are the Feldkirch-Buchs and Lautracht-St. Margarethen railways. Some 13 sq. miles on the Lake of Constance belong to Vorarlberg, which possesses only 121 sq. miles of land classed as unproductive, the remainder comprising 66·58 per cent pastures, 29·45 per cent wooded land, and 3·97 per cent agricultural, viticultural, and horticultural land.

A mountain land, Vorarlberg comprises in the north the Bregenzer Wald, a branch of the Algäuer Alps, traversed by the valley of the Bregenz Ach and draining to the Boden-See (Lake of Constance). Bezau is the chief place (pop. 1100). In the south are the Rhätikon Alps and the Silvretta group, north of which are the Ill Valley, the Klostertal, and Montafontal. The western versant drains to the Rhine, and the eastern, by the Lech, &c., to the Danube. Employments are connected almost entirely with the pastoral industry, except in towns, where the spinning and weaving of cotton, &c., is the staple.

Voronezh, a former government of Russia. Area, 25,450 sq. miles; pop. 3,492,000. It is intersected by the Don, which receives the whole of the drainage, partly through its tributaries the Voronezh and Khoper. Large crops of grain are raised.

Voronezh, a town of Russia, on the Voronezh. It is an important entrepôt on the railway between Moscow and the Sea of Azov. It has manufactures of woollen and linen cloth, soap, and vitriol, tanneries, and a considerable trade. Pop. 79,000.

Vortex, in the popular sense of the word, a mass of fluid, especially water or air, the particles of which are moving in circles about a common axis. When a rotating liquid has a free surface exposed to the atmosphere, the resultant of gravity and centrifugal force must be perpendicular to the free surface at any point. This is the cause of the hollows or dimples which may often be observed in slowly moving streams. In hydrodynamical theory, the word vortex has a different sense, being used to denote any portion of fluid in which there is *molecular* rotation (see *Hydrodynamics*). A smoke ring is a vortex in this theoretical sense.

Vorticella, or **Bell-animalcule**, a genus of stalked infusoria, having a fixed stem capable of being coiled into a spiral form, and vibratile cilia fringing the bell-shaped disc, which are constantly in rapid motion and attract particles of food. Some bells are free-swimming, and reproduction is effected by longitudinal fission; conjugation takes place by fusion of a small free-swimming individual with a large stalked one. The species are very numerous in fresh water, and are generally microscopic. Some closely related forms, e.g. Zoothamnium, are colonial.

Vorticism, an English movement in art comparable to Cubism and Futurism on the Continent. It is related to Futurism (q.v.) in seeking to express the mechanical character of modern industrial life; but rejects its methods as being merely a development of Impressionism (q.v.). It is related to Cubism in claiming that the sole concern of art is with form, and that the artist's business is not to reproduce the appearance of nature, but to create new realities. These ideas apply to every form of art, since every kind of emotion experienced by an artist has an appropriate form of expression in an appropriate material, either words, solid matter, or colours and shapes on a flat surface. These forms, however, are not symbols of these emotions, but direct channels for their conveyance. The word vorticism is derived from *vortex*, which is held to represent a generalized conception in the artist's mind of relations in the universe, through which ideas pass and take concrete shape; as in the general equation of a circle in analytical geometry, the substitution of numbers for the letters converts the general into a particular circle. Leading figures in the early days of the movement were Ezra Pound, poet and writer; H. Gaudier-Brzeska (1891–1915), sculptor; Wyndham Lewis, Frederick Etchells, William Roberts, Edward Wadsworth, and Cuthbert Hamilton, painters. In 1913 they were associated in the production of two numbers of a periodical *Blast*, wherein their theories were expounded; and they exhibited at the London group, seceding later to form the X group. Their earlier work was mainly based on three dimensional geometric forms; but individual members soon broke away from this convention, and the tendency in every case has been towards closer reproduction of natural appearance. Thus, from purely abstract patterns, Wyndham Lewis has passed to representing the structure of natural objects, chiefly of the human body. For practical purposes the movement is dead.—Cf. Ezra Pound, *Life of Gaudier-Brzeska.*

Vosges (vōzh), a chain of mountains about 100 miles long, extending N.N.E. to S.S.W. through North-Eastern France, nearly parallel with the Rhine. The breadth varies from 20 to 45 miles, and the highest peak is Ballon-de-Guebwiller, 4685 feet. Great part of the Vosges is densely wooded, and the eastern and southern slopes are often covered with vineyards. There is also excellent pasturage. The Ill, Lauter, Moselle, Meurthe, Saar, and Saône rise in this chain.

Vosges, an eastern department of France; area, 2303 sq. miles. It is bounded on the east by the Vosges Mountains, which send out ramifications over the greater part of its surface, whilst in the south it is traversed by the chain of the Faucilles. Grain, hemp, flax, and potatoes are extensively grown, and the department is famous for its kirsch-wasser. The principal rivers are the Meuse, Mouzon, Madon, Moselle, Saône, and Meurthe, all unnavigable within the department. The minerals are valuable. Manufactures include cotton and lace. Épinal is the capital. Pop. (1921), 383,684.

Vossius, Gerhard Johann, Dutch classical scholar, born in 1577, died in 1649. In 1614 he undertook the direction of the theological college at Leyden, and subsequently became professor of rhetoric and chronology. Favouring the Remonstrants, he became obnoxious to the prevailing party in the Church, and was deprived of his office. In 1633 he was invited to Amsterdam to occupy the chair of history, and continued there till his death. Several of his sons, especially Isaac (1618–89), also distinguished themselves as scholars.

Votyak, a division of the Permian group of the Turanian family of peoples and languages. The Votyaks, about 420,000 in number, are Christians, and inhabit the valleys of the Vyatka and the Kama, in the Russian government of Vyatka (q.v.), although some are found in Ufa. There has been considerable intermarriage with neighbouring Turanians of Tatar stock.

Vulcan (Lat. *Vulcānus*), in Roman mythology, the god who presided over fire and the working of metals, and patronized handicraftsmen of every kind. By some writers he is said to have been born lame, but by others his lameness is attributed to his having been thrown from Olympus. He was completely identified with the Greek Hephæstus (q.v.).

Vulcanite, or **Ebonite**, is a hard variety of india-rubber obtained by heating raw rubber, mixed with from 20 to 50 per cent of sulphur, for several hours at a temperature of about 140° C. Filling materials are sometimes added to cheaper varieties. The mixed mass is moulded to the required shape and placed in the vulcanizing chamber, which is heated by means of steam under pressure. Vulcanite is a hard, black, horn-like solid; it can be turned in a lathe and made to take a high polish. It is largely used in electrical work as an insulating medium, and, owing to its resistance to most chemical reagents, it is employed for making pipes, taps, &c., for use in many chemical industries.

Vulgate. The *Vulgate* is the Latin version of the Bible which was made by the great scholar Jerome towards the end of the fourth century, at the request of Damasus. Before long it became *the* Bible of the Western Church, and throughout the Middle Ages it was the standard and final court of appeal for dogma. The comparative lack of Greek scholarship left it with a free field, and its predecessors soon ceased to rival it, or even to exist. The Council of Trent, in the sixteenth century, formally pronounced Jerome's version to be the 'vetus et vulgata editio' of the sacred Scriptures. This ecclesiastical imprimatur only recognized the position gained long before by the version, which for over a thousand years had represented the Bible to Western Europe. The term *Vulgate* is derived from the participle *vulgata* (meaning 'current' or 'commonly received'). Latin being the language of the ecclesiastical and political as well as of the literary world, the *Vulgate* naturally prevailed, and even such vernacular versions as had occasionally been tolerated were made, not from the original Hebrew or Greek, but from the *Vulgate*—or, as it was then called, 'our edition' or 'the New Version'. It was the real Bible of the Middle Ages. That it did not represent the original accurately, that it was based on a Greek text which was not altogether primitive, and that its own text was not pure—all this was unsuspected till scholarship reawakened at the Reformation.

The Council of Trent's declaration that the *Vulgate* was the only, undisputed Word of God, containing the authoritative text of the Scriptures, was a novelty, "in violent opposition to the best usages of the Mediæval Church. It cast aside as worse than useless the whole scholarship of the Renaissance both within and outside of the Mediæval Church" (Lindsay, *History of the Reformation*, vol. ii, p. 573). But this decision was accompanied by another, which was equally momentous, for the Council of Trent also committed the Roman Church to the acceptance of all the books in the *Vulgate* version as canonical. This had one novel feature. The canon represented in the *Vulgate* of the New Testament is indeed the ordinary canon. There has never been, at any rate since the fifth century, much uncertainty about what books ought to be regarded as canonical in the New Testament. There have been some differences of opinion as to their order, but that is all. It was otherwise with the Old Testament canon. Jerome had translated and included in his version not only the ordinary books which are to-day regarded as canonical, but 'apocryphal' (it is Jerome's own term) books, such as the Wisdom of Solomon, Ecclesiasticus, Judith, and Tobit, the first two books of the Maccabees, and (marking these specially) the Story of Susanna, the Song of the Three Children, and the Story of Bel and the Dragon. These last-named books are Jewish additions to the books of Daniel.

The *Vulgate* canon, therefore, is: Genesis, Exodus, Leviticus, Numbers, Deuteronomy, Joshua, Judges, Ruth, Samuel, Kings, Chronicles, Ezra, Nehemiah, Tobit, Judith, Esther (with apocryphal additions), Job, Psalms, Proverbs, Ecclesiastes, Canticles, the Wisdom of Solomon, Ecclesiasticus, Isaiah, Jeremiah, Baruch, Lamentations, Ezekiel, Daniel (with apocryphal additions), the minor prophets, first and second Maccabees, and (relegated later to an appendix) first and second Esdras, and the Prayer of Manasseh.

During the Middle Ages, in spite of repeated efforts to preserve the *Vulgate* text in a pure condition, it became seriously corrupted; although the Council of Trent planned an official text, nothing was done by the authorities until, under the auspices of Pope Sixtus V (1585–90), the Sixtine edition was issued. Even this was unsatisfactory. Under his successor, Pope Clement VIII, the more successful Clementine edition was published in 1592. At present Roman scholars are at work upon a pure text of this standard authority.

BIBLIOGRAPHY: The standard work on the subject is S. Berger's *Histoire de la Vulgate pendant les premiers siècles du moyen âge* (Paris, 1893). There are discussions of the Old Testament canon in W. R. Smith's *Old Testament in the Jewish Church*; of the New Testament canon and Jerome's translation of the New Testament, in B. F. Westcott's *General Survey of the History of the Canon of the New Testament*, and in A. Souter's *Text and Canon of the New Testament* (1913).

Vulture, the common name for the raptorial birds belonging to the family Vulturidæ, characterized by having the head and part of the neck destitute of feathers, and a rather elongated beak, of which the upper mandible is curved at the end. The strength of their talons does not correspond with their size, and they make more use of their beak than of their claws. In general they are of a cowardly nature, living chiefly on dead carcasses and offal. Their geographical distribution is confined chiefly to warm countries, where they act as scavengers. There are two families, one (Cathartidæ) including New World forms, and the other (Vulturidæ) those native to the Old World. The chief American types are the condor (*Sarcorhamphus gryphus*), king vulture (*Gyparchus papa*), Californian vulture (*Pseudogryphus californianus*), turkey-buzzards (species of Rhinogryphus), and the American black vulture (*Catharista atratus*). Among Old

Egyptian Vulture (*Neophron percnopterus*)

World forms may be mentioned: common black vulture (*Vultur monachus*), griffon vulture (*Gyps fulvus*), and the Egyptian vulture (*Neophron percnopterus*). See separate entries.

Vyatka, or **Viatka**, an eastern government of Russia. Physically it is a plateau covered with low hills (1400 feet above Nolinsk), and draining to the Volga by the Kama and Vyatka. There are many lakes and great marshes. The climate is severe, and at Slobodka, on the Lyetka, the mean annual temperature is 34·5° F. (January mean, 5·3°; July mean, 65·3°). Vyatka is the capital; other towns are Orlov and Elabuga. Iron provides the chief industry, and is mined and manufactured within the government (ironworks at Kamsko-Votkinsk and Izhevsk); but the population (80 per cent Russian and the rest mainly Tsheremisses and Votyaks, q.v.) is overwhelmingly agrarian, and Vyatka was one of the granaries of Imperial Russia. It is also noted for ponies, and there is a great yearly pelt and fur market at Kotelnich. Leather, chemicals, and brandy are subsidiary products. Area, 59,329 sq. miles; pop. (1923 estimate), 2,100,000.

Vyatka, a town of Russia, capital of the government of Vyatka, on the Vyatka; the junction for Petrograd on the Perm-Kotlas Railway. It has a large river trade with Kazan (cereals, leather, soap, &c.). The mean annual temperature is 35° F. (January mean, 8·2°; July mean, 67·0°). Pop. 25,000.

Vyrnwy, a river of Wales, in northern Montgomeryshire, a tributary of the Severn. Lake Vyrnwy, the chief reservoir of the Liverpool waterworks, was formed by damming the upper part of the river. It has an area of close on 2 sq. miles. The work was carried out between 1890 and 1910.

W

W, the twenty-third letter of the English alphabet, representing a consonantal sound formed by opening the mouth with a contraction of the lips, such as is performed in the rapid passage from the vowel sound *u* (*oo*) to that of *i* (*ee*). The character is formed, as its name indicates, by doubling the *u* or *v*. At the end of words or syllables it is either silent, as in *low*, or it modifies the preceding vowel, as in *new*, *how*, having then the power of a vowel.

Wabash (wạ′bash), a river of the United States, which rises in Mercer county, Ohio, traverses Indiana, forms the boundary between Indiana and Illinois, and falls into the Ohio after a course of 550 miles. It is navigable for steamboats to La Fayette, and connects Lake Erie with the Ohio by the Wabash and Erie Canal.

Wabash, a city of Indiana, United States, the county seat of Wabash county, on the Wabash River; served by the Wabash and other railways. It is an agricultural centre, and has manufactures of agricultural implements, &c. Settled in 1834, it became a city in 1866. Pop. 10,000.

Wace, an Anglo-Norman poet, a native of Jersey, born about 1115, died about 1180 or 1184. Two important works by him remain, the *Brut d'Angleterre*, and the *Roman de Rou*, a history of Rollo and the Dukes of Normandy.

Wächtersbach, a town in the Prussian province of Hesse-Nassau, a junction on the Bebra-Frankfurt-am-Main railway, for Birstein (pop. 1200), and Bad Orb (a spa with three mineral springs; pop. 5000). Dyeing, brewing, &c., are carried on. Pop. 2000.

Waco, a city of Texas, United States, the county seat of M'Lennan county, on the Brazos River; served by the Missouri, Kansas & Texas, and other railways. It is the seat of two universities, and is an agricultural centre. Settled in 1849, Waco became a city in 1909. Pop. 38,500.

Wad, or **Bog Manganese**, a black or dark-brown earthy mineral composed of hydrous manganese oxide, allied to psilomelane. It is mainly formed in swamps and bogs, and its formation is probably assisted, like that of bog iron ore, by bacterial action.

Wada′i, or **Waday′**, a part of French Equatorial Africa, formerly a native state of the Sudan, with a population estimated at about 1,000,000, and an area of 170,000 sq. miles. It consists principally of a plateau, and comprises much desert, but produces maize, millet, cotton, &c., in parts. Wadai was recognized by Britain and Germany as under French influence, and in 1903 the people accepted the protectorate of France. The prevailing religion is Mahommedanism. Capital, Abeshr.

Wadelai, a town of Uganda, on the Bahr el-Jebel (Nile), below Lake Rubi. The district became British in 1894, and Wadelai was the chief station of Emin Pasha (Dr. Edward Schnitzer), Governor of the province, who, after the Mahdist rising, was cut off from civilization, and was relieved by H. M. Stanley. It is a hot place with a mean annual temperature of 79·3° F. Rain falls all the year round, but the driest period is from December to February. July and August are the coolest months, March the hottest, and October the month of greatest rainfall.

Wädenswil, a town of Switzerland, in the canton of Zürich, on Lake Zürich; the junction for Einsiedeln, on the Glarus-Zürich railway. Silk-weaving is the chief industry. Pop. 10,000.

Wadgassen, a town of the Saar Valley; the junction for Völklingen on the Teterchen-Bous (pop. 4200) railway. Pop. 5000.

Wadham College, Oxford, an institution endowed with estates purchased by Nicholas Wadham, of Meryfield, Somersetshire, and opened in 1613. Among distinguished men of Wadham College have been Admiral Blake, Sir Christopher Wren, and Frederic Harrison.

Wages have been conveniently defined by an American economist, Francis Walker, as " the reward of those who are employed in production with a view to the profit of their employers, and are paid at stipulated rates ". The term is loosely used: sometimes to include the reward of all kinds of labour, whether of hand or brain; sometimes in reference exclusively to the payments made weekly by employers to their workpeople. The general laws of supply and demand are applicable to the reward of labour. Wages tend to a level at which the demand for labour equals the supply. If labour is scarce, wages will rise; and if the supply exceeds the demand, and there is general unemployment, wages will fall. An increase in the supply of labour may, however, be brought about in two different ways: it may be due to an increase in the efficiency of a given number of workers, or to an increase in the size of the population. Increased efficiency usually means both a decrease in labour costs to the employer and an increase in the earnings of the worker. An increase in the number of workers, through the growth of population, however, must result in lower real wages, unless it is accompanied by an increase in the demand for labour. This fact gave rise in the early days of economic science to the doctrines of ' the iron law of wages ' and ' the wages fund ', both implying that there was a fixed and limited fund from which alone wages could be drawn, and that any increase in the remuneration of one set of workers must therefore involve a decrease in the earnings of the rest. Later economists have profoundly modified this view, by pointing out that changes in efficiency and numbers must result in changes in the amount of the national dividend, and therefore in the share of it which goes to labour.

Wagner, Wilhelm Richard, was born at Leipzig in 1813, died at Venice in 1883. He was reared in a theatrical and musical atmosphere, which no doubt helped him to overcome what in a lesser man would have been the disadvantages of a very desultory musical education. He studied for a short time under Gottlieb Müller, and later, in 1831, with Theodor Weinlig. In 1833 he was appointed chorus-master at the Würzburg theatre, and in the autumn of the following year music-director at Magdeburg. Here he first met Minna Planer, a singer at the theatre, whom he married in 1836. The marriage was not happy. In connection with the acceptance and production of his various operas, Wagner had more than the usual worries. He wrote a great deal in a vain endeavour to make his objects and ambitions plain to the general public. From 1839 to 1842 he lived in Paris by hack-work, and was often in great financial straits. In 1842 he went to Dresden, where *Rienzi*, produced in that year, was received with enthusiasm. *The Flying Dutchman*, first performed at Dresden in 1843, disappointed the public; *Tannhäuser*, performed in 1845, puzzled them still more. Though Wagner had little to do with the political upheaval of 1849, he was in danger of arrest, and, after the riots in Dresden, had to retire into exile till 1861. During this period he was occupied with *The Ring* and *Tristan and Isolde*.

In 1863 he published the complete poem of the *Ring des Nibelungen* as a literary product, intimating that he hardly expected to find leisure to complete the music and had no hope of seeing it performed. In the following year King Ludwig II of Bavaria came to the throne, and became an enthusiastic patron of Wagner. The *Ring* was ultimately completed, though there was no performance of the entire work till Aug., 1876, when it was given three times at Bayreuth in the new theatre specially built for the purpose according to Wagner's own design. *Parsifal* was completed in Jan., 1882. Wagner had separated from his wife in 1861, and in 1870 he married Cosima von Bülow, daughter of Liszt.

Wagner's aim in his operas was to unite the separate arts of music, poetry, painting, &c., into a complete whole, and though in a measure he was successful, the supreme quality of his works is always the musical. His idea of ' leading motives ', i.e. melodic or harmonic phrases specially identified with a particular character or object of the drama, made a tentative first appearance in *Lohengrin*, and was completely adopted in his subsequent works. His greatest operas are *Tristan and Isolde*, *The Mastersingers*, and *The Valkyrie*. He has been justly called " the grandest and most original dramatic composer of all time ".—BIBLIOGRAPHY: W. E. Ashton, *Life of Richard Wagner*; H. T. Finck, *Wagner and his Works*.

Wagram, a village of Austria, on the Russbach; served by the Breclava (Lundenburg)-Vienna Railway. It is famous for the great battle in 1809 between the French under Napoleon and the Austrians under the Archduke Charles, each about 150,000 strong. The battle was well contested, but the result gave Napoleon a decisive victory, which was followed up by an armistice and the Treaty of Vienna or Schönbrunn (14th Oct.).

Wagtail, a name of small perching birds of the family Motacillidæ, and so termed from their habit of jerking their long tails when running or perching. They inhabit meadow-lands and pastures, frequent water-pools and streams, are agile runners, and have a rapid flight. The food consists of insects. Their nests, built on the ground, contain from four to six eggs. These birds belong to both Old and New Worlds, and migrate southwards in winter; but the pied wagtail (*Motacilla lugubris*) is a permanent resident in Britain. It is almost wholly black on the upper parts; the under parts are greyish-white. Other representative varieties, distributed principally over the European continent and the East, are the white wagtail (*M. alba*), the grey wagtail (*M. melanopes*), and the yellow wagtails (*M. flava* and *M. rayii*).

Waha'bites, or **Wahabis**, a Mahommedan sect, founded in Arabia about 1760 by Abd-el-Wahâb, an Oriental scholar of high attainments (1704–92). He deemed it his mission to restore Islam to strict harmony with the teachings of the *Koran* and the *Sunna*. Thousands flocked to the Wahabite standard, and enabled the reformer to secure the whole of his native province, Nejd, and to carry his victorious arms into Yemen. Under his successors the greater part of Arabia fell under the Wahabite power. Mecca and Hejaz were captured in 1803, and the loss of the sacred city roused the Turks to action. Several expeditions were sent from Egypt, and in 1818 Ibrahim Pasha was at last successful in dispersing the Wahabite forces, in capturing their capital, Derayeh, and their leaders, who were executed at Constantinople. They, however, gradually regained their influence, especially in their native homes of Nejd. From Arabia the Wahabite movement spread into Africa, where it influenced the founder of the Senussi brotherhood, and into India. In its modern form, although referred to as the Akhwan movement, Wahabism is the foundation of the power of the emir of Nejd and Hasa (q.v.).

Waika'to, one of the principal rivers of New Zealand, in North Island; length, about 200 miles.

Waits, the name given at one time to the king's minstrels, whose duty it was to guard the streets at night and proclaim the hour; to the musicians of a town; and to private bands when employed as serenaders. The term is now applied to those who sing or play carols on Christmas and New Year's Eve with a view to donations.

Waiver, in English law, is the renunciation or abandonment of a right. The renunciation or abandonment may be express, e.g. by deed, or implied, e.g. by the party possessing the right in full cognizance of it either neglecting duly to enforce it or performing acts which, being inconsistent with its subsistence, are indicative of an intention to abandon it. The doctrine of waiver is important in judicial proceedings. If a party to a cause desires to have any judicial proceeding set aside on the ground of irregularity, he must make application to the court to that effect within a reasonable time after the irregularity has come to his notice and before he has taken any further step in the proceedings with the knowledge of it; otherwise he is held to have waived his right.

Wakamatsu, a town of Japan, in the Island of Honshu; served by the Tokyo-Sendai Railway. It has a State steelworks. Pop. 44,000.

Wakatip'u, a lake in the South Island of New Zealand; area, 114 sq. miles. Queenstown and Glenorchy, on the borders of the lake, are favourite tourist resorts, on account of the magnificent mountain scenery in the vicinity.

Wakayama, a town of Japan, a prefecture capital, in the Island of Honshu; served by rail to Osaka. Pop. 83,500.

Wake, a term corresponding originally to *vigil*, and applied to a festival held on the anniversary of the day on which the parish church was consecrated and dedicated to a saint. A *lyke* or *lich wake* (A.-S. *lîc*, a corpse) is the watching of a dead body by night by the relatives and friends of the deceased. The practice, once general, is now confined to Irish Roman Catholics.

Wakefield, a borough and episcopal city of England, in the West Riding of Yorkshire, on the Calder. The industrial establishments include woollen-mills. The cathedral church of All Saints dates from the fifteenth century, and the grammar-school from 1591. The bishopric was created in 1888, mostly from that of Ripon. Pop. (1921), 52,892.

Walcheren (vâl'ke-rên), an island of the Netherlands, in the province of Zeeland, at the mouth of the Scheldt. It is level, below high-water mark, very fertile, populous, and prosperous. It contains the towns of Flushing (Vlissingen), Middelburg (capital), and Veere. On 30th July, 1809, the British expedition under Lord Chatham (elder brother of Pitt) landed near Veere, and took it, Middelburg, and Flushing, but had to retire in the following December, after losing 7000 men by marsh fever.

Waldeck (*Freistaat Waldeck*), a republic of the German Reich, hilly, drained to the Weser by the Eder (with the Werbe and Aar) and the Diemel (with the Twiste); served by the Korbach-Arolsen-Warburg, the Wabern-Wildungen, and the Korbach-Frankenberg railways. Arolsen is the capital: the baths of Wildungen (Niederwildungen; pop. 4000) are world-famous, and the waters are exported. About 55 per cent of the area is cultivated meadow land, and 38 per cent is wooded. There is a cattle-raising industry. The mean annual temperature is from 45° to 49° F. Waldeck is governed by a Landtag of 21 members, elected for three years. Area, 433 sq. miles; pop. 660,000 (mainly Lutherans).

Pyrmont, an enclave of Brunswick, Hanover, Lippe, and the detached Prussian appanage Lügde, was united by a personal bond with Waldeck, through the reigning house. Ruled by its own counts until 1494, in 1557 it passed to Lippe and in 1583 to the Counts of Gleichen, coming under Waldeck in 1625, and remaining a Waldeck principality until 1918. On 1st April, 1922, it was absorbed in the province of Hanover. Pyrmont (pop. 2600), on the Emmer, is the chief town, and is one of the best-known health-resorts in Europe. There are six mineral springs and a mud bath, visited by about 30,000 persons yearly. Area, 25·5 sq. miles; pop. 10,000 (90 per cent Lutheran).

Waldenburg, (1) a town of Saxony, on the Zwickauer Mulde; served by the Glauchau-Penig (pop. 7000) railway. Woollens, cottons, &c., are made. Pop. 4000. (2) A town of Prussian Silesia, the centre of the Waldenburger Gebirge coal-field; an important junction on the Kohlfurt-Glatz railway for the Dittersbach-Salzbrunn line. There is a porcelain factory, and machinery, matches, and linen are made. Pop. 18,000. Important mineral springs exist at Salzbrunn (eight springs; the chief spa in Silesia; pop. 12,000), and Charlottenbrunn (on the Kohlfurt-Glatz line; pop. 2000). (3) A town and spa of Württemberg; a junction on the Heilbronn-Halle railway from Künzelsav (pop. 3200). Pop. 2000.

Walden'ses, or **Vaudois**, a Christian sect owing its origin to Peter Waldo (Waldus), a citizen of Lyons, who collected numerous followers in the twelfth century. Recent historians are of opinion that the Waldensian movement is really a fusion of four distinct reform movements which originated from the tenth to the twelfth century. The design of the founder of the Waldensian movement was to reform the clergy, and to preach the word of God freely to everyone in his native language, but subsequent followers went far beyond the original plan. They made the Bible alone the rule of their faith, renounced entirely the doctrines, usages, and traditions of the Roman Church, and formed a separate religious society. Excommunicated as heretics, the Waldenses for centuries suffered merciless persecutions, which only ceased in the eighteenth century. Their stronghold is in the mountain tract of the Cottian Alps, and since 1848 they enjoy equal religious and political rights with the Roman Catholics of Italy. Separate congregations were founded in various parts of Europe, but amalgamated with other reformed sects. The Waldensian rites are limited to baptism and the Lord's Supper, respecting which they adopt the doctrine of Calvin. Their congregations are superintended by consistories composed of elders and deacons, under the presidency of a moderator.—*Cf.* J. Gibson, *The Waldenses.*

Wales, a principality in the south-west of the Island of Great Britain, which since Edward I gives the title of Prince of Wales to the heir-apparent of the British Crown; area, 7363 sq. miles; pop. (1921), 2,206,712. It is divided into twelve counties, for the names and areas of which see the article *England.* As a whole it is very mountainous, particularly in the north, where Snowdon, the culminating point of South Britain, rises to the height of 3560 feet; and it is intersected by beautiful valleys, traversed by numerous streams, including among others the large river Severn. It is rich in minerals, particularly coal, iron, copper, and even gold, and to these Wales owes its chief wealth. The coal trade is most extensive, and Cardiff is one of the largest coal ports in the world. Swansea may be considered one of the greatest oil ports. Iron, steel, and copper works are on a large scale. Besides the mineral industries, there are considerable woollen manufactures, especially of flannel, coarse cloth, and hosiery. (See *England* and *Britain.*) The inhabitants are almost purely Celtic in race, being the descendants of the early Britons, who were able to maintain themselves here when the rest of the country was overrun by the Germanic invaders. A majority of the inhabitants are Nonconformists or Dissenters, such as Congregationalists, Calvinistic Methodists, and Baptists.

Previous to the Roman occupation Wales appears to have been chiefly inhabited by three British tribes, called the Silures, Dimetæ, and Ordovices. During the later period of the Roman occupation the subject part of the island was divided into four provinces, of which one, including the country from the Dee to the Severn, was called *Britannia Secunda.* It was after the invasion of the Saxons that the country acquired a distinctive national character as the refuge of the vanquished Britons who were gradually driven to the west. From this period until the final conquest of the country by Edward I there is little but a succession of petty wars between the rival chiefs or kings into which both countries during a great part of the Saxon period were divided, or the more systematic efforts of the larger monarchy to absorb the smaller. Among the greatest of the Welsh heroes of the early period was Cadwallon. After being defeated by Edwin of Deira, or Northumbria, and compelled to flee to Ireland, he returned and defeated the Saxons in numerous battles, but was at last defeated and slain by Oswald of Northumbria in 635. The last of the Welsh princes, Llewellyn, who revolted against Edward I, was defeated and slain by the Earl of Mortimer in 1284, and since that time the principality has been incorporated with England.

The native name of the Welsh language is Cymraeg, the speech of the Cymri (q.v.). The names Wales and Welsh are of Anglo-Saxon origin, from *wealas*, strangers, foreigners (plural of *wealh*). The Welsh language is, with the other Celtic languages, included in the Indo-European group. The alphabet contains thirteen simple and seven double consonants, and seven vowels, with numerous diphthongs and triphthongs. It is still spoken exclusively by more than a quarter of a million of the inhabitants of Wales. The necessities of commerce are, however, gradually doing for the Welsh language what they have done for the Irish and Gaelic, and English is becoming more and more the language of everyday life in Wales. The earliest remains of Welsh literature are supposed to belong to the ninth century. There are a number of poetic pieces attributed to Taliessin, Aneurin, Merlin, and Llywarch Hen, bards supposed to have lived in the fifth century; but great and reasonable doubts have been thrown on the authenticity of these early productions, which, in their present form at least, are not believed to be earlier than the eleventh century. Subsequent to this time there were numerous poems written, many in praise of warriors, others dealing with love, or descriptive of nature. Dafydd ap Gwilym (1293–1356) has been called the Ovid of Wales. Huw Morris (1622–1709) and Goronwy Owen (1722–80) are likewise distinguished as poets. The last produced the *Cywydd y Farn* (*Day of Judgment*), regarded as the finest poem in the language. There are a number of prose tales or romances, the chief of which are contained in a collection known as the *Mabinogion*. The first Welsh book ever printed appeared in 1546. Modern works in Welsh are mostly confined to theology, history, and biography. See *Celtic Civilizations*; *Celtic Literature*; *Celtic Mythology*; *Celts*; articles on various counties and towns; maps of England and Wales under England.

Walka, or **Walk**, a town of Esthonia, on the Latvian frontier and the River Peddell; an important junction on the Riga-Petrograd Railway for Pärnu (Pernau), Pskov, Aluksne (Marienburg), and Tallinn (Reval). There are flax markets, and grain is traded. Pop. 10,000.

Walker, George, Irish clergyman, born of English parents, in County Tyrone, in the early part of the seventeenth century, and killed at the battle of the Boyne in 1690. He studied theology at Glasgow University, and after taking orders obtained the living of the parish of Donoughmore. The arrival of James II in Ulster (1689) caused Walker to seek refuge in Londonderry; and in the memorable siege of that city he took the most prominent part both in word and deed. After the siege Walker went to London, was presented with the bishopric of Derry and £5000, and Parliament voted him its thanks. Instead of taking quiet possession of his bishopric, he accompanied William III in his Irish campaign, and fell a victim to his courage.

Wallace, Alfred Russel, British scientist, born at Usk, Monmouthshire, in 1823, died in 1913. Educated at Hertford grammar-school, he spent many years in travelling, especially in South America and the Asiatic Islands, and the valuable material collected in these scientific explorations he embodied in *Travels on the Amazon and Rio Negro*, *The Malay Archipelago*, *Tropical Nature*, *The Geographical Distribution of Animals*, &c. His observation of animal life early led him on to the track of natural selection, and before Darwin gave his famous work to the world he had written an essay anticipating *The Origin of Species*. His share in establishing the theory was acknowledged by Darwin. But while Darwin, in his later editions of *The Origin of Species*, somewhat modified his original conclusions, Wallace, in his mature work, *Darwinism, an Exposition of the Theory of Natural Selection, with some of its Applications* (1889), insisted upon the controlling effect of the survival of the fittest in the struggle for existence. He, however, differed from Darwin on the subject of the intellectual, moral, and spiritual nature of man. He contended that the higher faculties have been developed not under the law of natural selection, but under a higher law, which has come in imperceptibly; and that the Darwinian theory, instead of opposing, " lends a decided support to a belief in the spiritual nature of man ". He claimed to be at once a true Darwinian and an anti-materialist. Among his later publications are: *Man's Place in the Universe*, *Social Environment and Moral Progress*, and *The Revolt of Democracy*.—Cf. J. Marchant, *Alfred Russel Wallace: Letters and Reminiscences*.

Wallace, Sir William, the hero of Scottish independence, is said to have been the younger son of Sir Malcolm Wallace of Elderslie and Auchinbothie, by Margaret, daughter of Sir Reynold Crawford, sheriff of Ayr. He was probably born about 1270. For the most detailed particulars we possess about this famous Scottish character we are almost entirely dependent on Blind Harry; but the narratives cannot bear the scrutiny of the critical historian. Contemporary Scottish records do not exist, while the English chroniclers of the period were but imperfectly informed and prejudiced. Wallace is described as a man of herculean proportions and strength, and it is certain that he possessed in a high degree the qualifications of a commander.

He is represented as having been for some years engaged in a partisan war against the English before what is represented by Blind Harry as the turning-point in his career took place, the slaughter of Haselrig in revenge for the murder of his wife, and in pursuance of his vow of eternal vengeance against the invaders of his country. Henceforth he continued in open resistance to the English, and, having collected a considerable force, was besieging the castle of Dundee when he heard that Surrey and Cressingham were advancing upon Stirling with a large army. He met them in the vicinity of that town, and, thanks to his ingenious military tactics, gained a complete victory (1297). After this Wallace appears with the title of Guardian of the Kingdom, which was temporarily cleared of the English, and is found conducting a series of organized raids into England. In 1298 Edward I entered Scotland with an army estimated at nearly 90,000 men. Wallace retired before him, wasting the country, but was at length overtaken at Falkirk, and compelled to fight. After a gallant resistance his army was routed. He succeeded in escaping, and little is known of his movements henceforth. He was excluded from the peace granted by Edward to the Scottish Council of Regency in 1304, and every effort was made to secure his apprehension. It was effected through Sir John de Menteith, governor of Dumbarton Castle. Wallace was conveyed to London, and after a mock trial found guilty of treason and rebellion, and executed on 23rd Aug., 1305. A memorial to Wallace has been placed on the summit of Abbey Craig, near Stirling, in the form of a Scottish baronial tower, surmounted by an architectural crown, and having a height of 220 feet.—BIBLIOGRAPHY: James Moir, *Sir William Wallace*; A. F. Murison, *Sir William Wallace*; P. F. Tytler, *History of Scotland*.

Wallace, William Vincent, musical composer, was born of Scottish parents at Waterford 1818, died in France 1865. In 1845 he went to London, and devoted himself to composition. His first opera, *Maritana*, was produced at Drury Lane, 1845, and secured him at once a reputation. *Lurline* and *The Amber Witch* are his other chief operatic compositions.

Wallace Collection, a collection of pictures, sculptures, arms and armour, furniture, china, &c., belonging to the British Government, and now displayed in Hertford House, Manchester Square, London, W. It was bequeathed to the nation in 1897 by Lady Wallace, widow of Sir Richard Wallace (1818–90). Hertford House was acquired for £80,000, and the collection was first open to the public in 1900.

Wallaroo, a seaport-town in South Australia, on the Spencer Gulf, 91 miles north of Adelaide. The Wallaroo and other copper-mines are in the neighbourhood, and smelting-works are carried on at Wallaroo Bay. Pop. 3300.

Wallasey, an urban district and municipal borough of Cheshire, England, on Wirral Peninsula, at the mouth of the Mersey. The grammar-school was originally founded in 1595, and the parish church of St. Hilary is a tenth-century foundation (rebuilt about 1790; tower dates from 1530). Liscard, Seacombe, Poulton, &c., are included within the municipal borough. Pop. (1921), 90,721.

Wallenstein (vȧl′en-stīn), Albrecht Wenzel Eusebius von, Duke of Friedland, Bohemian soldier and statesman, born at Hermanic, in Bohemia, 1583, assassinated at Eger 1634. He served first in Hungary, and in 1618, at the outbreak of the Thirty Years' War, he joined the imperial forces against his native country. His estates, valued at 30 million florins, he was allowed to form into the territory of Friedland, and in 1624 he was created Duke of Friedland. He raised a large army to assist the emperor against the Lower Saxon League; he defeated Count Mansfeld at Dessau (April, 1626), and compelled Bethlen Gabor to conclude a truce; he conquered Silesia, and bought from the emperor, partly with military services, partly with plunder, the Duchy of Sagan, and other extensive estates. In Sept., 1630, owing to the jealousy of the nobles and the licence of his followers, he was deprived of his command, and retired to his Duchy of Friedland until the emperor was compelled to seek his aid against Gustavus Adolphus. After some partial successes Wallenstein encountered the King of Sweden at Lützen (16th Nov., 1632), in which battle Wallenstein was defeated and Gustavus killed. Wallenstein had unsuccessfully treated on his own account with the Swedish king, and he now secretly reopened negotiations with France and the German princes, occasionally taking the field to display his military power. Wallenstein was at last removed from his command, and was preparing openly to attack the imperial forces, when he was assassinated at Eger by Colonel Butler and his fellow-officers, Gordon, Leslie, and Devereux.

Waller, Edmund, English poet, was born at Coleshill (then a detached portion of Hertfordshire, but since 1832 absorbed by Buckinghamshire) in 1606, and died at Beaconsfield in 1687. He came of a good family, and was educated at Eton, and King's College, Cambridge. He was elected member of Parliament for Amersham, according to some accounts, when only sixteen years of age; he was certainly elected for Ilchester when eighteen. He was thus 'nursed in Parliaments', and had a long and brilliant, though not always honourable, career in the House. He eventually became the Nestor of the assembly, and discharged this part with much diligence. In 1631 he married Anne Banks, a London heiress, who died three years later. In about 1635 he began to address verses to Lady Dorothy Sidney, daughter of the Earl of Leicester, whom he celebrated under the name of Sacharissa (Lat. *saccharon*, sugar). It is tolerably certain that his intentions towards this lady were honourable but not matrimonial. As a member of the Long Parliament he opposed the raising of troops by Parliament; in 1643 he was leader in a plot (known as 'Waller's Plot'), to seize London for the king. His conduct resembled that of the poet Lucan (q.v.), for he informed against his fellow-conspirators to save his own life; he differed from Lucan, however, in achieving his purpose. He was expelled from the House of Commons, fined £10,000, and banished. He married a second time, and went to France. In 1651 Waller was pardoned by Cromwell's influence, and four years later published *A Panegyric to my Lord Protector*, which gained him the appointment of Commissioner of Trade. After the Restoration he wrote a poem, *To the King, upon His Majesty's Happy Return*. When the king complained that the former poem was superior to the latter, the poet replied with happy promptitude, "Sir, we poets never succeed so well in writing truth as in fiction".

Waller enjoyed, during his life-time and for some while after his death, a great reputation as a poet. This reputation mainly rested upon a volume of poems which was issued in 1645. He was a careful writer, and the merit of much of his work consists in the absence of faults rather than in any positive virtues. As a lyric poet he is chiefly remembered by one poem, *Go, lovely Rose*. As a writer of heroic couplets, he is famous for having effected a revolution in that metre. He introduced, or at any rate popularized, the self-contained couplet, thus preparing the way for Pope and Dryden. Some of his fame was doubtless due to his social position, his charm of manner, and his ready eloquence. His poetry lacks sincerity and strength, though it has smoothness as well as those saccharine qualities which he admired in the inspirer of much of his work. Unlike most of his contemporaries, however, Waller avoided conceits and far-fetched ingenuities in his verses.

Wallflower, the common name of the species of plants belonging to the genus Cheiranthus, nat. ord. Cruciferæ. They are biennial or perennial herbs or under-shrubs. Many of them exhale a delicious odour, and are great favourites in gardens. The best known is the *C. Cheiri*, or common wallflower, which, in its wild state, grows on old walls and stony places. In the cultivated plant the flowers are of more varied and brilliant colours, and attain a much larger size than in the wild plant, the flowers of which are always yellow.

Wallis, John, English mathematician, born in 1616, died in 1703. Educated for the Church at Emmanuel College, Cambridge, he took orders in 1640, and in 1663 obtained a living in London. He was Savilian professor of geometry at Oxford and one of the earliest and most prominent members of the Royal Society, founded in 1663. His works include: *Arithmetica Infinitorum* (1655); *De Angulo Contactus et Semicirculi Tractatus* (1656); *De Cycloide* (1659); *Mechanica, Sive de Motu Tractatus Geometricus* (1669–71); &c.

Walloons. See *Belgium*.

Wallsend, a town of Northumberland, on the Tyne. It is named from being situated at the eastern extremity of the Roman Wall, and was formerly famous for its coal. There are blast-furnaces, engineering-works, chemical-works, &c. Pop. (1921), 43,013.

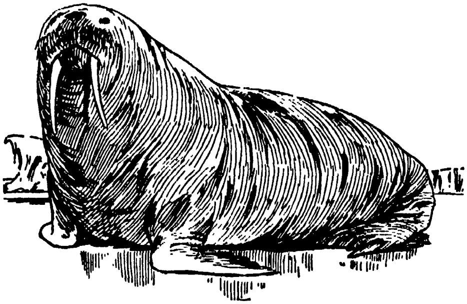
Walnut, the common name of trees and their fruit of the genus Juglans, nat. ord. Juglandaceæ. The best-known species, the common walnut tree (*J. regia*), is a native of several Eastern countries. It is a large handsome tree with strong spreading branches. The timber of the walnut is of great value, is very durable, takes a fine polish, and is a beautiful furniture wood. It is also employed for turning and fancy articles, and especially for gun-stocks, being light and at the same time hard and fine-grained. The ripe fruit is one of the best of nuts, and forms a favourite item of dessert. They yield by expression a bland fixed oil, which, under the names of *walnut-oil* and *nut-oil*, is much used by painters, and in the countries in which it is produced is a common article of diet. In copper-plate printing it is employed to produce a fine impression, either in black or colours. By boiling the husks when beginning to decay, and the bark of the roots, a substantial dark-brown colour is obtained, which is used by dyers for woollens, and also by cabinet-makers to stain other species of wood in imitation of walnut. The fruit, in a green state, before the shell hardens, is much used for pickling. The black walnut (*J. nigra*) is found in most parts of the United States of America, and in favourable situations the trunk often attains the diameter of 6 and 7 feet. It yields a wood preferable to the European walnut, but the nuts are inferior. The butternut (*J. cinerea*) is another noteworthy variety. See *Butter-nut*.

Walpole, Horace, Earl of Orford, British author, wit, and letter-writer, the fourth son of Sir Robert Walpole, born 24th Sept., 1717, died 2nd March, 1797. He was educated at Eton, and King's College, Cambridge, on leaving which he travelled two years on the Continent in company with Gray the poet. Returning in 1741, he entered the House of Commons, and he sat for various constituencies up to 1768. In 1747 he purchased Strawberry Hill, near London, where he erected a Gothic villa, laid out the grounds with minute ingenuity, and made it a principal business of his life to adorn and furnish it with objects of curiosity and antiquarian interest. His maintenance was provided for by some sinecure appointments, obtained through his father's influence. To his antiquarian taste he added authorship, first in verse and afterwards more extensively in prose, and in 1757 he established a private printing-press at Strawberry Hill, at which he printed not only his own works but those of others. In 1791 he succeeded his nephew in the peerage. He never took his seat in the House of Lords, and appears to have avoided using his title. The works of Horace Walpole are numerous; but his fame as a writer rests on his *Letters* and *Memoirs*. The former are held to be unsurpassed in the English language, and both are highly interesting and valuable as a storehouse of the more evanescent traits of contemporary history. His romance *The Castle of Otranto* set the fashion, followed by Mrs. Radcliffe and Clara Reeve, of writing ' tales of terror '. Walpole's manners were affected; he was fastidiously aristocratic, sensitive to criticism, and eager for applause; but under his vanity and frivolity there existed a substratum of good sense and sound judgment.—BIBLIOGRAPHY: E. Warburton, *Memoirs of Horace Walpole*; Austin Dobson, *Horace Walpole*; Mrs. Paget Toynbee's edition of Walpole's *Letters* (16 vols.).

Walpole, Sir Robert, Earl of Orford, English statesman. A younger son of Sir Robert Walpole, member of Parliament for Castle Rising, he was born in 1676, and died in 1745. He was educated at Eton, and at King's College, Cambridge; succeeded to the paternal estate in 1700, and entered Parliament as member for Castle Rising. In 1702 he was elected for King's Lynn, became an active member of the Whig party, and soon distinguished himself by his business capacity, and by his easy, plausible, and dispassionate debates. He was Secretary of War and leader in the Commons in 1708, Paymaster of the Forces in 1714 and 1720, and First Lord of the Treasury and Chancellor of the Exchequer in 1715, and again in 1721. From the latter date until 1742 he held without interruption the highest office in the State. During his long administration the Hanoverian succession, to which he was zealously attached, became firmly established, a result to which his prudence and political sagacity largely contributed. He promoted by an enlightened policy the commercial prosperity of the nation, and relieved the weight of taxation by many improvements in the tariff. In 1724 he was made a Knight of the Bath, in 1726 a Knight of the Garter, and on 9th Feb., 1742, two days before his resignation, he was created Earl of Orford. In an age famous for venality and lax morals he was the least corrupted, the soberest, and the hardest working of the leaders of both factions.—BIBLIOGRAPHY: Lord Morley, *Walpole* (Twelve English Statesmen Series); W. Coxe, *Memoirs of the Life and Administration of Sir Robert Walpole.*

Walpurga, or **Walpurgis**, a female saint, born in England early in the eighth century, died 779. As a niece of St. Boniface, and sister of St. Willibald, first Bishop of Eichstädt, Bavaria (741–786), she was induced to proceed to Germany to found convents, and in 754 she became abbess of Heidenheim, where she died. The eve of the 1st May, associated with some of the most popular witch superstitions of Germany, is called *Walpurgis-night*, but her feast falls properly on the 25th of February.

Walrus, a marine carnivorous mammal, the single species constituting a genus Odobenus, as well as the family Odobenidæ, and belonging, with its allies the seals, to the pinnigrade section of the order Carnivora. The walrus, which is also known as the morse, sea-horse, and sea-cow, has a general resemblance to the seals, but is especially remarkable from the upper canine teeth being enormously developed in the adults, constituting two large pointed tusks directed downwards and slightly outwards, and measuring usually 12 to 15 inches in length, sometimes even 2 feet and more. There are no external ears. The animal exceeds the largest ox in size, attaining a length of 20 feet. It is monogamous, and seldom produces more than one young at a birth; gregarious but shy, and very fierce when attacked. It inhabits the high northern latitudes, where it is hunted by whalers for its blubber, which yields excellent oil; for its skin, which is made into a


Walrus

durable leather; and for its tusks. Their favourite food consists of crustaceans and bivalve molluscs.

Walsall′, a county and municipal borough of England, in the county of Stafford. The present town is almost entirely modern. Extensive coal, iron, and limestone deposits in the immediate vicinity, and ample canal and railway communication with leading trade centres, have made it an important manufacturing town. Brass- and iron-foundries are numerous and on a large scale; and for saddlers' and carriage-builders' ironmongery, tools, locks, and keys, &c., Walsall has long been famous. Pop. (1921), 96,964.

Walsingham, Sir Francis, English statesman, born about 1530, died in 1590. After studying at King's College, Cambridge, he travelled on the Continent for some time, and acquired a good knowledge of foreign languages and politics. He was introduced by Cecil, Lord Burleigh, to public service, and employed in embassies to France, the Netherlands, and Scotland. He also sat in the House of Commons for various constituencies, and occupied important public offices. His sagacity and discretion caused him to be much employed, often against his own desire, in the intrigues of Elizabeth, especially against Mary Queen of Scots. The unravelling of the Babington Plot was entrusted to Walsingham, and he was also one of the commissioners who tried Queen Mary.

Waltham, a city of Massachusetts, United States, in Middlesex county, on Charles River; served by the Boston & Maine railway. It is the seat of the Waltham watch manufactory, and also manufactures cottons, organs, and motor-cars. Settled in 1640, it became a city in 1884. Pop. (1920), 30,915.

Waltham Abbey, or **Waltham Holy Cross**, a town of Essex, England, on the Lea. Part of an old abbey church founded by King Harold in 1060 now belongs to the parish church. The abbey once possessed a miraculous cross. There are Government explosives factories. At Waltham Cross, in Hertford, 1½ miles from Waltham Abbey, is one of Edward I's crosses. Pop. (1921), 6847.

Walthamstow, an urban district of Essex, England, part of Greater London. It is the Domesday *Wealanestun*. Pop. (1921), 127,441.

Walther von der Vogelweide, one of the best mediæval German lyric poets of the class of *minnesingers*, was born about 1170, died at Würzburg about 1230. A politician and reformer as well as a poet, he was in favour of the Emperor as against the Pope, and by his songs influenced the art and politics of his time.

Walton, Izaak, English writer, was born at Stafford on the 9th Aug., 1593, and died at Winchester on the 15th Dec., 1683. He went to London, where he was apprenticed to an ironmonger. In 1614 he started for himself, and had a shop in Fleet Street, near Chancery Lane. He became a freeman of the Ironmongers' Company in 1618. His earliest literary productions were copies of verses prefixed to books written by his friends. In 1626 he married the great-grand-niece of Archbishop Cranmer. She died in 1640; and in 1646 he married a step-sister of Thomas Ken, afterwards Bishop of Bath and Wells. He thus knew many Anglican clergy. Donne and George Morley, afterwards Bishop of Winchester, were among his intimate friends. In 1640 he wrote a life of Donne, which was prefixed to an edition of his sermons; this was added to and issued separately in 1655. He also wrote lives of Sir Henry Wotton (1651), Richard Hooker (1665), George Herbert (1670), and Bishop Robert Sanderson (1678). Walton had known all these men except Hooker; he had been a close friend of Donne and Wotton; his acquaintance with Sanderson had been slighter; Herbert he had only met. His biographies are all good—indeed are all masterly—but he has done most justice to the men he knew most intimately. Walton's masterpiece, however, is *The Compleat Angler*, which first appeared as a small octavo, price eighteenpence, in 1653. A second edition, containing twenty-one chapters (the first edition had only thirteen), came out in 1655. A third edition appeared in 1661, a fourth in 1664, a fifth in 1668, and in 1676 the work, with treatises by Venables and Charles Cotton, was given to the world as *The Universal Angler*. Since then there have been over a hundred editions. Walton seems to have lived an ideally tranquil and happy life. Although a keen Royalist, he took no part in the Civil War, except to take care of King Charles's 'Lesser George', or badge of the Order of the Garter, after the battle of Worcester. He retired from business in the prime of life, and lived to a great age, spending his time in fishing and in pleasant intercourse with his friends. He was not a prolific writer, but everything that he wrote was as good as he could make it. He has managed to convey to us indirectly in his writings something of the charm of his own personality. Like Lucilius, "the life of the old man is clearly set down, as it were, on a votive tablet". His biographies show him to us in a serious, work-a-day frame of mind; in *The Compleat Angler* we see him in holiday mood. His style is always natural and charming; the spirit which lives in the opening lines of Chaucer's *Prologue* animates all his work. In his temperament, Walton is the last of the Elizabethans. *The Compleat Angler* has been criticized for giving no accurate information about fishing. It is no more a mere manual of fishing than the *Georgics* is a manual of agriculture. Walton is an idyllist; his work is an amplification of the text 'Study to be quiet'. The singular happiness of his nature has given immortality to his descriptions of the country; and we may say of him what Melibœus said to Tityrus:

> Fortunate senex, ergo tua rura manebunt.

—Cf. S. Martin, *Izaak Walton and his Friends.*

Waltz, a widely popular dance in triple time. It is of German origin, being a development of the *ländler*, a country dance of similar style, but danced more slowly. The waltz originated in Bohemia, Austria, and Bavaria about the latter half of the eighteenth century, and is first met with in England about 1790. Both at home and on the Continent it was received with great hostility, but, nevertheless, won its way in time to universal favour, and during the nineteenth century it was the most popular of all dances. Music for the waltz is written in the simplest of forms, consisting essentially of eight-bar phrases in pairs. Two phrases suffice for the simple requirements of the *ländler*, the best examples of which are to be found in the *Deutsche Tänze* of Beethoven and Mozart. The waltzes of Schubert are mainly written according to the same plan, but show an artistic development in their wider harmonic scheme and their variations from the regularity of the eight-bar phrases. Weber in his *Invitation to the Dance* completed the emancipation of this form from the mechanical requirements of the ballroom, and made of the waltz a developed piece of music. Chopin and Brahms are the two greatest waltz-writers. For purposes of dancing the waltzes of Johann Strauss are pre-eminent, with those of Gung'l and Waldteufel not far behind.

Walvis Bay, the chief seaport of the South-West Africa Protectorate; a nodal point of the Protectorate railways. It is 21 miles south of Swakopmund, the former German port which has been more or less silted up by the Benguella current, and is developing as a health-resort. The mean annual temperature at Swakopmund (20 feet altitude) is 59·5° F. (March, 63·5°; May, 70°; August, 55° F.), and the rainfall 0·7 inches (0·2 inches in March and December, 0·1 inches in October and February, and practically none at all during the rest of the year). In March, 1878, Walvis Bay and the circumjacent territory became British, and was annexed (1884) to Cape Colony, Britain thus possessing herself of the best port of entry to German South-West Africa, of which Walvis Bay was an enclave until the termination of the local operations during the European War. See *South-West Africa* under *Towns*, *Railways*, and *History*.

Wanderoo (*Macăcus silēnus*), a monkey inhabiting Ceylon and the East Indies. The length is about 3 feet to the tip of the tail, which is tufted, and much resembles that of the lion; the colour of the fur is deep black; the callosities on the hinder quarters are bright pink; a well-developed mass of black hair covers the head, and a great greyish beard rolls down the face and round the chin. The same name is given in Ceylon to a species of Semnopithecus.

Wandsbek, a town of Prussia, Germany, on the Wandse. It is a suburb of Hamburg. Manufactures include beer and spirits, tobacco, leather, oil, machinery, and sugar-goods. Pop. 35,000.

Wandsworth, a south-western metropolitan borough of the county of London, comprising the parishes of Streatham, Lower Tooting, Putney, and Clapham. It is called after the Wandle, which disembogues into the Thames here. Area, 9107 acres; pop. (1921), 328,656.

Wantage, a town and agricultural centre of Berkshire, England. It is the birth-place of King Alfred, and was a residence of the Saxon kings. There is a grammar-school. Pop. (1921), 3628.

Wapentake, the name formerly given in some of the northern shires of England, and still given in Yorkshire, to a territorial division of the county, corresponding to the *hundreds* of the southern counties.

Wap'iti, a species of deer, the North American stag (*Cervus canadensis*), which more nearly resembles the European red-deer in colour, shape, and form than it does any other of the cervine race, though it is larger and of a stronger make, its antlers also being larger. It is found in Canada and the northern parts of the United States from the Atlantic to the Pacific. Its flesh is not much prized, being coarse and dry, but its hide is made into excellent leather.

Warbeck, or **Osbec**, Perkin, a pretender to the English throne, born about 1474, died in 1499. He was set up by Margaret of York, Dowager-Duchess of Burgundy, as a pretender to the crown of England against Henry VII. For this purpose she recognized him as her nephew, Richard Plantagenet, Duke of York, the younger of the two princes who were murdered in the Tower by Richard III. He was patronized by France and Scotland, married a kinswoman of the Scottish king, James IV, made several fruitless invasions of England and Ireland, was taken prisoner after an attempt on Cornwall (Oct., 1497), and confined to the Tower, where, his plotting being continued, he was executed (Nov., 1499).—Cf. James Gairdner, *Richard III and the Story of Perkin Warbeck.*

Warblers (Sylviinæ), the name applied to a sub-division of the thrush family, generally small, sprightly, very shy, and remarkable for the clearness, sweetness, and flexibility of their song.

Insects form their food, and most of them are migratory. The typical warblers belong to the genus Sylvia (q.v.).

War'burton, William, British prelate, born at Newark-upon-Trent in 1698, died at Gloucester in 1779. He was brought up to the law, but not finding this profession to his taste he relinquished it, and in 1723 took deacon's orders in the Church. In 1727 he began to distinguish himself as a writer by his inquiry into the *Causes of Prodigies and Miracles*. This led to his being presented to the rectory of Brand Broughton, in Lincolnshire. In 1736 appeared his first important work, the *Alliance between Church and State*, &c., which brought him into favourable notice at court; but his great work is the *Divine Legation of Moses*. A defence of Pope's *Essay on Man* secured him the friendship of the poet, and he became a considerable beneficiary under the latter's will. In 1746 he was appointed preacher to the society of Lincoln's Inn, and from that time his advance in Church preferment was rapid, until he became Bishop of Gloucester in 1759.—Cf. J. S. Watson, *Life of William Warburton*.

Ward, Mary Augusta (Mrs. Humphry Ward), novelist, granddaughter of Dr. Arnold of Rugby, born 1851, died 1920. Her chief novels include: *Robert Elsmere* (1888), a novel of religious doubts and perplexities; *The History of David Grieve*; *Marcella*; *Sir George Tressady*; *Helbeck of Bannisdale*; *Lady Rose's Daughter*; *The Marriage of William Ashe*; *Missing* (1917); and *Fields of Victory* (1919).—Cf. Janet Penrose Trevelyan (daughter), *Life*.

Ward, in English law, one who is under guardianship through want of full legal capacity, as an insane person or an infant (i.e. a person under twenty-one years of age). If the court has appointed a guardian or assumed protection of an infant without making such appointment, the ward is then called a 'ward of court'. Any infant against whom an action has been raised becomes a ward of court and entitled to its protection, though he has a guardian. The consent of the court is necessary to the marriage of a ward of court. The court may remove a child from the custody of its father if its welfare so demands; may dismiss any guardian who has acted dishonestly or improperly in his trust; and may assume control of the ward's estates.

The term 'ward' is also applied to an electoral division of a county, parish, city, or borough for purposes of local government.

Ware, a market town of England, in Hertfordshire, on the Lea. The chief industries are brick-making and malting for the London breweries. Pop. (1921), 5949.

Wareham, an ancient town of England, in Dorsetshire, near the mouth of the Frome. Pop. (1921), 1997.

War Loans are the sums of money borrowed by a Government for the purpose of financing a war. In so far, however, as this borrowing is carried out by means of Treasury Bills, or by private transactions with the Bank of England and the joint-stock banks, it is not customary to use the term War Loan, which is, in practice, confined to the funded debt taken up by the general public. Early in the European War, i.e. Nov., 1914, a £350,000,000 War Loan at 3½ per cent was issued, but drew very little response from the public, and a large part of it was taken up by the Bank of England and subsequently repaid out of the proceeds of the War Loan of 1915. In June of that year a 4½ per cent War Loan was issued, which, including conversions of 3½ per cent War Loan, Consols, &c., produced total applications for £900,000,000, and actual cash receipts of £585,000,000. In Oct., 1916, £150,000,000 6 per cent Exchequer Bonds, repayable in Feb., 1920, were issued. In 1917 a great 5 per cent War Loan was issued, which realized over £1,000,000,000; while in the second half of 1917 a system of continuous borrowing by the issue of National War Bonds was instituted. By these means the British National Debt increased between 1913 and 1919 from £706,000,000 to £7,832,000,000.

Warminster, a market town of Wiltshire, England, on the west side of Salisbury Plain. Pop. 5547.

Warner, Susan, American writer, born 1819, died 1885. In 1851 she published, under the pseudonym of Elizabeth Wetherell, a story of the 'goody-goody' sentimentally pathetic order entitled *The Wide, Wide World*, which was highly popular on both sides of the Atlantic. *Queechy* (1852) was almost equally so, but her other books had no great success.

Warner, William, English author, born about 1558, studied at Oxford, became an attorney and man of letters in London, died in 1609. In 1585 he published seven tales under the collective title of *Pan, his Syrinx or Pipe*; but his principal work—the one which has kept his name alive—is *Albion's England*, a poem in fourteen-syllable lines, first published in four books (1586), afterwards extended to sixteen, dealing with the history of Britain from the days of Noah to James I, and containing an extraordinary hotchpotch of mythology, legend, and more or less genuine history and biography, &c. Warner also published a translation of the *Menæchmi* of Plautus, which Shakespeare may have seen in manuscript before he wrote *The Comedy of Errors*.

War Office, a British State department charged with the duty of carrying out the considered opinion of the supreme military authority, the Army Council. The Army Council consists of a president (the Secretary of State for War) and nine members, of whom five are serving soldiers. The head of the War Office is also the Secretary of State for War. At the head of each of the main departments into which the War Office is divided is a member of the Army Council, e.g. the department of the Chief of the Imperial General Staff is presided over by the officer holding that appointment. Similarly, the departments of the Adjutant-General to the Forces, the Quartermaster-General to the Forces, and the Master-General of the Ordnance are all in charge of members of the Army Council. These, with the Deputy-chief of the Imperial General Staff, make up the five military members of the Army Council as above. Then comes the department of the Under-Secretary of State for War and the Finance department, both of which are in charge of members of Parliament (of either House), and finally the Secretary's department, at the head of which is one of the joint-secretaries of the War Office, both of whom are members of the Army Council. The other joint-secretary is a member of the Finance department. Each of these main departments is further divided up into directorates, each under a general officer. For instance, in the department of the C.I.G.S., are the directorates of military operations, military intelligence, and Staff duties; in that of the Adjutant-General to the Forces are directorates of organization, personal services, army medical services, hygiene, and pathology; under the Quartermaster-General are the directors of movements and quarterings, remounts, supplies and transport, equipment and ordnance stores, and veterinary services; while the Master-General of the Ordnance deals with a director of artillery, a director of fortifications and works, and a director-general of factories. This is the principle of the delegation of responsibility which is constant throughout the army. See *Army*; *Staff*.

Warrant, an instrument or document authorizing certain acts which without it would be illegal. Warrants may be divided into royal or executive, judicial, and commercial warrants. The first include *Death*, *Extradition*, *Royal Arms* (authority to use the royal arms), and *Treasury Warrants* (authority to receive payments at the Treasury). Common forms of judicial warrants are: the *Warrant of Arrest*, usually issued by a justice of the peace for the apprehension of those accused or suspected of crimes; the *Warrant of Commitment*, a written authority committing a person to prison; the *Distress Warrant*, a warrant issued for raising a sum of money upon the goods of a party specified in the warrant; the *Search Warrant*, an authority, generally granted to police-officers, to search private premises. Commercial warrants usually authorize the delivery of goods or money, such as *Dock-warrants*, *Dividend Warrants*, &c.

Warrant-officer, in the army an intermediate rank between commissioned officers and non-commissioned officers. Warrant-officers, as the term implies, are appointed by 'warrant' issued by the War Office. Promotion to warrant rank takes place on the application of the commanding officer of the unit on the occurrence of a vacancy. The following among others are warrant officers: conductors, Royal Army Ordnance Corps; master-gunners, first-class; regimental sergeant-majors; band-masters; and certain schoolmasters. Warrant rank in the Royal Marines is practically identical with the same rank in the army, but in the Royal Navy warrant-officers rank next below commissioned officers, are entitled to the salute, and wear uniforms that are only to be distinguished from those of commissioned officers by the buttons on the sleeves, the size of the gold-lace band, and the wearing of plain shoulder-straps.

Warranty, in law, a guarantee or security; a promise or covenant by deed, made by a bargainer for himself and his heirs, to warrant or secure the bargainee and his heirs against all men in the enjoyment of an estate or other thing granted.

Warrington, a municipal, parliamentary, and county borough of Lancashire, England, with a small portion in Cheshire. It stands on the Mersey, about midway between Liverpool and Manchester. River, canal, and railway communication secure it exceptional carrying facilities. Tanneries, iron-, glass-, and soap-works, cotton-mills, and breweries are numerous and extensive. A dock exists near Warrington in connection with the Manchester Ship Canal. Pop. (1921), 76,811.

Warrnambool, a seaport-town of Victoria, Australia, 170 miles south-west of Melbourne. It lies in a fertile agricultural district, and has an extensive trade in wool, flour, and dairy produce with Melbourne. Pop. 7403.

War'saw (Pol. *Warszawa*; Ger. *Warschau*; Fr. *Varsovie*; Russ. *Varshava*), the largest city of Poland, the republican capital, extending for over 5 miles along the left bank of the Vistula; served by rail to Bialystock, Deutsch-Eylau, Lodz, Kraków (Cracow), &c., and by steamers on the Vistula downstream to Thorn (Torún) and upstream to Sandomir (Sandomierz). Two bridges connect it with Praga, a suburb on the right bank of the river containing the two termini of the eastern railways. Warsaw is famous for its huge churches, numerous and magnificent palaces and monuments, remnants of former Polish grandeur; for its educational institutions; and for its many and extensive gardens, parks, and suburban drives. It was formerly also exceptionally rich in literature and art treasures; most of which were removed by the Russians to Petrograd. Leather, boots and shoes, woollen and linen stuffs, plated ware, machinery, beer, potato-starch, locomotives, paper, and tobacco are some of the most important industrial products, and in the district toys, musical and surgical instruments, gloves, artificial flowers, flour, glassware, and watches are manufactured. There is a Government printing-works at Warsaw. Pop. (1921), 931,176.

Wart (Verruca) is a small papillary excrescence of horny character most frequently seen on the hands, but occurring on any part of the body. There are several varieties, and probably several factors which cause their production. Some types are undoubtedly contagious, but no germ has as yet been discovered. They may be flat or pedunculated, and of varying degrees of hardness. In the treatment of warts great care should be taken in the use of strong acids, and if acids are used in liquid form the best is acetic. A slow, but painless and usually successful, method is the repeated application of salicylic-acid plaster.

Wartburg (vȧrt′bụr*h*), an ancient mountain castle in Germany, near Eisenach, in Saxe-Weimar. It was built in 1067 as a residence for the landgraves of Thuringia. Here, according to the legend, took place the poetic contest known as the 'War of the Wartburg', between Walther von der Vogelweide and six other eminent poets of Germany, in 1206. It was the residence of Luther in 1521–2, and the room in which the great reformer worked at the translation of the Bible is still shown.

Warthe′ (vȧr′tė), or **Warta**, a river of Germany. It rises in Poland, 35 miles north-west of Cracow, and joins the Oder at Küstrin. Total length, 483 miles, of which 220 miles are navigable.

Wart-hog, a name common to certain members of the hog family, genus Phacochœrus, distinguished from the true swine by their dentition, which in some respects resembles that of the elephants. The head is very large; immense tusks project from the mouth outwards and upwards, and the cheeks are furnished with flesh-like excrescences resembling warts. They feed on the roots of plants, which they dig up with their tusks. The African wart-hog or haruja (*P. africanus*) of Abyssinia, and the vlackevark of the Dutch settlers of the Cape (*P. æthiopicus*) are distinct species.

Warton, Thomas, English poet and critic, born at Basingstoke 1728, died at Oxford 1790. He was educated at Winchester, and Trinity College, Oxford, and early distinguished himself by his poetical compositions and criticisms. He was chosen professor of poetry at Oxford in 1757, a chair he filled with great ability for ten years; appointed Camden professor of history in 1785; and succeeded Whitehead as Poet Laureate in the same year. He rendered great service to literature by his *History of English Poetry* (1774–81; 3 vols.), a work never completed.

Warwick, Richard Neville, Earl of, 'the kingmaker', English nobleman, born 1428, killed 1471. He was the son of an Earl of Salisbury, and became Earl of Warwick by marrying the heiress of the title and estates. Taking the Yorkist side in the Wars of the Roses, he was the main instrument in placing Edward IV on the throne (1461) in place of Henry VI, and became the most powerful nobleman in the kingdom. Quarrelling with Edward on account of the latter's marriage, he went over to Henry's side, and was able to place him again on the throne, but was defeated and slain at the battle of Barnet.—Cf. Sir C. W. C. Oman, *Warwick, the King Maker*.

Warwick (wo′rik), a municipal borough of England, on a rocky hill on the right bank of the Avon, the county town of Warwickshire. The principal object of interest is Warwick Castle, the most magnificent of the ancient feudal mansions of the English nobility. Pop. (1921), 12,862.

Warwickshire, a midland county of England; area, 902 sq. miles. The surface is undulating and drained chiefly to the Avon and the Tame. There is a large amount of pasture for dairying and grazing purposes. Coal and several kinds of building-stone are abundant. Warwickshire is also famous for its manufactures, and includes the two great manufacturing towns of Birmingham and Coventry. Pop. (1921), 1,390,092.

Wash, The, a large estuary on the east coast of England, between the counties of Norfolk and Lincoln. When the tide is full, the whole is under water; when out, large stretches are dry. Boston Deeps and Lynn Deeps give access to sea-going vessels.

Washington, George, first President of the United States, 'the father of the Republic', born in Westmoreland county, Virginia, 22nd Feb., 1732, died at Mount Vernon 14th Dec., 1799. He was the great-grandson of John Washington, an Englishman, who emigrated in 1657, and the son of Augustine Washington, a substantial farmer. His education was limited, but he acquired a fair knowledge of mathematics and surveying, chiefly by self-study, and when his widowed mother prevailed upon him to abandon the idea of entering the British navy, he adopted surveying as a profession. His military career commenced at the age of nineteen, when he was appointed adjutant-general of

Virginia militia; and before long he showed in operations against the French that he united in an eminent degree the qualities belonging to a successful commander, though in 1754, when in command of his regiment, he had to capitulate to a superior French force. In 1755 he accompanied General Braddock as a volunteer, and was almost the only officer who returned safe from the disastrous expedition. In 1758 he took an important part in the expedition that captured Fort Du Quesne, where Pittsburg now stands. In the meantime extensive estates and plantations at Mount Vernon had come into his possession through the death of his half-brother. To these possessions he added largely by marrying, in 1759, Mrs. Martha Custis, a wealthy young widow. He also sat for some years in the Virginia Assembly. Shortly after the outbreak of the War of Independence, Washington was elected Commander-in-Chief of the American forces (5th June, 1775), in which capacity his career belongs to the general history of his country. It is sufficient to say that the struggle was carried on by him under extraordinary disadvantages, including unfriendliness on the part of officers, and virulent attacks on the part of others. When peace was signed in 1783 Washington retired to Mount Vernon, and refused all recompense for his invaluable services beyond his personal expenses. In 1787 he was a member of and presided over the Convention which met to revise the articles of union between the states, the result being the Constitution which is still in force, and which was adopted in 1788. Washington was elected the first President of the Republic, and inaugurated 30th April, 1789, and he was again elected in 1793. During both terms he performed the onerous duties of his office with marked ability, and the advances in prosperity made by the young Republic were extraordinary. At the close of his second term of office he resigned (1797), but when a misunderstanding with France threatened further trouble Congress appointed him Lieutenant-General of the Forces (1798). Washington had a mind far above party strife, and was mourned by men of all parties. He had no family. Mount Vernon, on the Potomac about 15 miles from Washington, became national property in 1858. His remains are deposited in a vault in the grounds.—BIBLIOGRAPHY: Washington Irving, *Life of George Washington*; H. C. Lodge, *George Washington*; C. Sheridan Jones, *A Short Life of Washington*; W. C. Ford (editor), *The Writings of George Washington.*

Washington, a maritime state in the Pacific Division of the United States, abutting on the British Columbia frontier. It is divided into two physical regions by the volcanic mountains of the Cascade range, which trend roughly from north to south. In the east is the plateau region, drained by the Columbia River (q.v.) and the Snake, its tributary. The former forms for about 300 miles the boundary of the state with that of Oregon, and its estuary provides the best harbour on the state's 180-mile stretch of coast-line on the Pacific. There is, however, in the western region over a thousand miles of coast-line on Puget Sound, the submerged northern end of the great valley that runs southwards into Oregon. On Puget Sound are found Olympia, the state capital, Seattle (the chief city), Tacoma, Bellingham, and Everett; Aberdeen (on Gray's Harbour on the Pacific coast) Spokane, and Walla-Walla are other cities. There are upwards of 7400 miles of ordinary and 1100 miles of electric railways, and shipping traffic on the Columbia and Snake Rivers and trans-Pacific are highly developed. Agriculture is progressive, assisted by irrigation in the eastern region. Besides the customary cereal and root crops, dairying, sheep-farming, and general stock-raising, there is a large fruit-growing industry, and the timber resources are extensive. Gold, silver, copper, zinc, lead, antimony, arsenic, &c., are found, but coal is the chief mineral, over 3,300,000 tons being produced in 1920. Of a total population (1920) of 1,356,621, 6883 were negroes, 20,900 Asiatics, and 9061 Indians, the latter occupying 2655 sq. miles (18 reservations). About 250,100 were aliens. Primary education is free and compulsory between the ages of eight and sixteen years, and there are two universities (Washington, near Seattle, and Puget Sound, at Tacoma), as well as a State college of science and agronomy at Pullman. State area, 69,127 sq. miles (2291 sq. miles being water).

Washington was created a territory in 1853 and became a state of the Union in 1889. There is a bicameral Legislature, comprising a Senate and a House of Representatives, Senators being elected for four years (one half of the Senate seeking re-election biennially), and Representatives sitting for two years. There are 39 counties. Two Senators and 5 Representatives are sent to Congress.

Washington, the capital of the United States, in the District of Columbia, at the confluence of the Anacostia with the Potomac, 200 miles south-west of New York. The site was selected in 1790 by Washington himself, and the plan of the city was drawn up on a most magnificent scale. The streets (70–120 feet wide) cross each other at right angles, and are intersected diagonally by avenues (120–180 feet wide), which bear the names of states in the Union. First among the numerous public buildings ranks the Capitol, one of the finest structures in the States, on a hill above the Potomac, in the midst of an ornamental park. It consists of a central building, two wings (each with a dome) of white marble, and a central dome of iron, surmounted by a statue of Liberty (total height, 307½ feet). The Rotunda, in the centre of the main building, is a magnificent hall, adorned with bas-reliefs and paintings, and a colossal statue of Washington. The Capitol accommodates Congress and the Supreme Court. The buildings provided for the various State departments, such as the Treasury, the State, War, and Navy departments, the Interior department, Post Office, &c., are also on a splendid scale. In the midst of these palatial offices stands the more modest yet elegant White House, the residence of the President. In addition may be specially mentioned the Smithsonian Institution, the Columbian College, the arsenal, the navy-yard, and the Washington obelisk, built of white marble and blue gneiss, 555½ feet high, with a base 104 feet square. The city is protected by numerous forts and batteries, the harbour defences especially being of a formidable description. Pop. (1920), 437,571.

Washington Conference, an international conference called by the United States. It met at Washington and was formally opened on 12th Nov., 1921, the concluding session being addressed by President Harding on 6th Feb., 1922. Among its achievements were: the Four-Power Pacific Treaty replacing the Anglo-Japanese Alliance; the Five-Power Treaty, prohibiting the use of submarines in attacking merchant ships, and the use of poison-gas in warfare; the Five-Power Naval Limitation Treaty, signed by the United States, Great Britain, Japan, France, and Italy; the settlement of the Shantung dispute between Japan and China; and the arrangement of Tariff and Open-Door Treaties regarding China. Great Britain, under the Limitation Treaty, was allowed to complete only two capital ships between 1922 and 1925, with no new building thereafter until 1931.

Wash'ita, a river of the United States, in Arkansas and Louisiana, an affluent of the Red River; length, 600 miles.

Wasp, the common name applied to insects of various genera belonging chiefly to the family Vespidæ, order Hymenoptera. Those best known belong to the genus Vespa, and live in societies, composed of females, males, and neuters or workers. The females and neuters are armed with an extremely powerful and venomous sting. Their nests, some of them very ingenious both as regards material and construction, are made in holes underground, or attached to the branches of trees, to walls, &c. The cells are of a hexagonal form, arranged in tiers with the mouth downwards, or opening sideways, in which the larvæ and pupæ are contained. Wasps are very voracious, eating other insects, sugar, meat, fruit, honey, &c. Several species are indigenous in Britain. The hornet (q.v.) is the largest. The most common species is the *Vespa vulgāris*, which is a ground wasp. North America has various species similar in habits to those of Europe.

Watch, a well-known pocket instrument for measuring time, invented at Nürnberg at the end of the fifteenth century. The wheels in watches are driven by a spiral spring, generally of steel, contained in a cylindrical barrel or box. The rate at which the spring is allowed to unwind, and so impart its motion to the train of wheels which control the hand movements, is regulated by the balance-wheel, hair-spring, and the escapement. In all but the best-class English watches the fusee, which is a coned part with a spiral on it which transmits the motion from the spring-barrel to the first wheel, has been abandoned in favour of the going-barrel. The latter offers better facilities for keyless work, and keyless watches are manufactured in increasing quantities. The going-barrel watch can also be produced at a cheaper rate, and for ordinary purposes is amply reliable. The main-spring in this class of watch is very long, but only a few coils are brought into action. The great wheel is attached to the going-barrel itself; thus the spring force is directly transmitted to the escapement. The invention of the spiral hair-spring by Dr. Hooke (about 1658), the scientific application of its properties since, and the intelligent use of compensation in the balance, have combined to give to the best chronometers of to-day a uniformity of rate which it is probably impossible to excel. Large quantities of the cheaper class of watches are now made by machinery in Switzerland, Germany, and the United States. The mechanism has been reduced to its simplest, though not necessarily an irregularly operating form, and the parts produced by repetitive manufacturing processes. In many countries these cheap watches are so popular that watch-repairing, as it is known in Britain, is no longer done.

Watch (nautical), a certain part of the officers and crew of a vessel who together work her for an allotted time, the time being also called a watch. The time called a *watch* is four hours, the reckoning beginning at noon or midnight. Between 4 and 8 p.m. the time is divided into two short or *dog-watches*, in order to prevent the constant recurrence of the same portion of the crew keeping the watch during the same hours.

Water, the commonest liquid in nature. It was classed among the elements until the close of the eighteenth century, when Lavoisier, profiting by the experiments of Cavendish, proved it to be a compound of hydrogen and oxygen, in the proportion of two volumes of the former gas to one volume of the latter; or by weight, 2 parts of hydrogen to 16 parts of oxygen; hence its formula is H_2O. Pure water is a colourless, tasteless, inodorous liquid; a powerful refractor of light; a bad conductor of heat; and very slightly compressible, its absolute diminution for a pressure of one atmosphere being only about 50 millionths of its bulk. Pure water is a bad conductor of electricity, but if it is slightly acidulated with sulphuric acid, an electric current can be passed through it, and the water is decomposed into its elements. Although water is colourless in small quantities, it is blue like the atmosphere when viewed in mass. It takes a solid form, that of ice or snow, at 32° F. (0° C.), and all lower temperatures; and it takes the form of vapour or steam at 212° F. (100° C.) under a pressure of 29·9 inches of mercury, and retains that form at all higher temperatures. Under ordinary conditions water possesses the liquid form only at temperatures lying between 32° and 212° F. It is, however, possible to cool water very considerably below 32° F. and yet maintain it in the liquid form. Water may also be heated, under pressure, many degrees above 212° F. without passing into the state of steam. The specific gravity of water is 1 at 39·2° F., and this is the unit to which the specific gravities of all solids and liquids are referred, as a convenient standard, on account of the facility with which water is obtained in a pure state; 1 c. inch of water at 62° F. and 29·9 inches barometric pressure weighs 252·5 grains. In grammes per litre (1000 c. c.) the weights of *water* at 4° C., *hydrogen*, and *air* are respectively 1000, 0·0899, and 1·293 (the gases at 0° C. and pressure 76 cm. of mercury). Water is at its greatest density at 39·2° F. (= 4° C.), and in this respect it presents a singular exception to the general law of expansion by heat. If water at 39·2° F. be cooled, it expands as it cools till reduced to 32°, when it solidifies; and if water at 39·2° F. be heated, it expands as the temperature increases in accordance with the general law. From the chemical point of view water is neither a distinct acid nor a base, it is neutral. It is decomposed by iron, zinc, magnesium, calcium, sodium, and potassium, the intensity of the action increasing from the first-mentioned to the last. It forms definite compounds with numerous substances; thus it combines with lime to form slaked lime, and with sulphur trioxide to form sulphuric acid. Numerous crystalline compounds contain water in a state of combination, known as *water of crystallization*, which is readily removed when the crystals are heated. Examples are blue vitriol, $CuSO_4, 5H_2O$; washing soda, $Na_2CO_3, 10H_2O$. Of all liquids water is the most general solvent, and on this important property its use largely depends. In consequence of the great solvent power of water, it is never found pure in nature. Rain in passing through the air dissolves small quantities of the atmospheric gases, chiefly oxygen, nitrogen, and carbonic acid. It may also contain common salt and, near towns, compounds of sulphur. Where the rain-water has filtered through rocks and soils, and reappears as spring or river water, it is always more or less charged with salts derived from the earth, such as sea-salt, gypsum, and chalk. When the proportion of these is small, the water is called *soft*; when larger, it is called *hard water*. The former dissolves soap better, and is therefore preferred for washing; the latter is often pleasanter to drink. The hardness of water is due to dissolved salts of calcium and magnesium. The hardness is *permanent* if the dissolved salts are chlorides or sulphates; but if the salts are bicarbonates, the hardness is *temporary*, and the water may be softened by boiling (which drives off the free carbonic acid, necessary to hold the bicarbonates in solution), or by Clark's process, in which slaked lime is added and reacts with the bicarbonates so as to form insoluble normal carbonates, which are precipitated, and can be removed. See *Filtration*; *Sea-water*; *Mineral Waters*; *Freezing*; *Ice*; *Steam*.

Water-beetle, the name given to various species of beetles, having legs adapted for swimming, the two hinder pairs being flattened and fringed with hairs. A well-known species is *Dytiscus* (or *Dyticus*) *marginālis* of British ponds.

Waterbury, a city of Connecticut, United States, a county seat of New Haven county, on the Nangatuck River; served by the New York, New Haven, & Hartford Railway. It is an important manufacturing town. Brass and brass goods are the staple products. Waterbury machine-made watches and clocks are known throughout the world. Electro-plate is also made. Settled in 1677, it became a city in 1853. Pop. (1920), 91,715.

Water-calyx, a curious condition found in some tropical flowers. The calyx forms a closed sac, and secretes from its inner surface—usually from special glandular hairs—a watery, slightly mucilaginous liquid, in which the other floral organs are immersed, until the flower is mature. When the flower opens, the liquid usually escapes or evaporates, owing to the bursting of the calyx; but in some Convolvulaceæ the water-calyx remains active until the fruit is ripe. Water-calyx is most frequent in the Bignoniaceæ, but also occurs in other families, such as Solanaceæ, Gesneraceæ, Vitaceæ, &c. Its significance is obscure. See *Spathodea*.

Water-colour, a method of painting in which the pigments are mixed with water as a medium, gum with a little glycerine or honey acting as binding material. In this form colour may be applied to any non-greasy surface; but the most usual grounds are paper and card, though fabrics such as silk and ivory (in miniature painting) are often used. The medium being transparent, the colour and quality of the ground have considerable influence on the appearance of the painting; and in the case of superimposed layers of colour (known as *washes*) those underlying affect the apparent colour of those on the surface. This, and the fact that the essence of water-colour is careful preservation of the lights which are given by the untouched ground, separates the process from oil, in which the medium is more or less opaque, and the lights are painted on. Sometimes, however, the colours are mixed with opaque white (sometimes called *body-colour*), which gives it somewhat the quality of oil paint. In this form, water-colour is often known as *gouache.* Used simply and directly, transparent water-colour has a delicacy and luminosity unrivalled by other media, though it lacks the range and intensity of oil. The best results are attained by broad washes, without attempts to modify or correct. In very skilful hands *washing-down* (lightening colour by repeated application of water), *scrubbing* (brisk rubbing of the moist colour with a rag or brush), and *scraping* (removing colour with a knife to lay bare the ground) are powerful weapons, but difficult to use. *Stippling* (the application of colour in small touches) permits elaboration of detail, but robs the medium of freshness and clarity. In the Far East, especially in China and Japan, water-colour has always been the principal medium employed. In Western Europe, however, its development as an independent art is comparatively modern. Both in transparent and opaque forms it was used in the illumination of manuscripts; and in the seventeenth century, especially in Holland, it became important in tinting drawings in chalk or ink, though it remained subsidiary to other media. In the eighteenth century, however, especially in England, it was much used by a group of topographic draughtsmen, who worked with the pen and coloured wash. Their work as a whole is prosaic and unimpressive, though occasionally a considerable artist emerges, such as the brothers Paul and Thomas Sandby. But it was Alexander Cozens and his son, J. R. Cozens, who can claim to have freed water-colour from its trammels, and helped to make it an independent means of artistic expression. They paved the way for Thomas Girtin (1775–1802), the first great master in water-colour. His larger and more elaborate paintings fail in an attempt to rival oil; but the breadth of design and delicate luminosity of colour in most of his work remain unsurpassed. Turner, despite his matchless technical skill, approximated water-colour to oil, thereby losing at times its characteristic beauty; but J. S. Cotman (1782–1842) at his best rivalled Girtin in technical perfection and beauty of design, with the use of a wider palette. With the foundation early in the nineteenth century of the Old Water-Colour Society (from which the present Royal Water-Colour Society sprang), the status of the water-colour painter may be regarded as assured. In David Cox and Peter de Wint, the medium found vigorous and able, if somewhat mechanical, exponents. Partly inspired by Turner, however, and encouraged by Pre-Raphaelite methods, the middle of the nineteenth century witnessed an era of stippling and over-elaboration typified by the work of Birket Foster and A. W. Hunt; but in the 'eighties came a vigorous return to the older tradition, represented by the water-colours of Whistler, Tom Collier, and J. Buxton Knight. From this arose the contemporary school, which includes (among others) A. W. Rich, Wilson Steer, C. J. Holmes, D. S. MacColl, D. Y. Cameron, and David Muirhead. The chief rivals to British supremacy in the nineteenth century were the Dutch school of The Hague, represented by Mauve, Willem Maris, and Jacob Maris; and certain painters of Northern France, notably Henri Harpignies. But the art remains primarily British.—BIBLIOGRAPHY: C. E. Hughes, *Earlier English Water-Colour Painters*; A. J. Finberg, *The English Watercolour Painters*; A. W. Rich, *Watercolour Painting.*

Water-cress (*Nasturtium officinăle*), a cruciferous plant distributed throughout Europe, Western Asia, North Africa, introduced into North America and certain British colonies, and choking some rivers of New Zealand, where the stem grows as thick as the wrist. It grows on the margin of clear streams, or even partly immersed in the water. It has antiscorbutic properties, and is cultivated near many large towns to be used as salad, or otherwise.

Waterford, a county of Munster, Ireland, has an area of 708 sq. miles, of which about a sixth is under tillage. The coast is in general bold and rocky, and besides the harbours of Waterford and Youghal, has the deep indentations of Dungarvan Harbour and Tramore Bay. The interior is largely rugged and mountainous. The principal rivers are the Suir and the Blackwater. There is a considerable extent of fine land in the south-east, and the hilly districts afford good pasture. Dairying is largely carried on. The fisheries are valuable. Pop. 56,502.

Waterford, a seaport-city of the Irish Free State, capital of the County of Waterford, on the Suir above its confluence with the Barrow, the estuary of the combined streams forming Waterford Harbour. There are large bacon-curing establishments, breweries, saw- and flour-mills, &c. The principal buildings are the Episcopal and Roman Catholic cathedrals. Pop. 27,564.

Water-gas, a combustible obtained by alternately raising hot solid fuel, such as coke, to incandescence by a blast of air, and then cooling it by the passage of steam through it to cause dissociation. Water-gas is commonly produced in gas-works, and is enriched with heavy hydrocarbon vapours, and used either by itself or mixed with ordinary coal-gas as a fuel. The simple untreated water-gas, or ' blue ' gas as it is termed, is sometimes used with coal-gas if the quality of the latter is above the normal. The temperature of the fuel is brought up to about 2000° F. before the steam is admitted, and drops to between 1500° and 1700° F. at the end of the run, after which the air-blast is used to raise it again. See *Fuels*.

Water-glass, or soluble glass, consists of sodium silicate, and is prepared by fusing silica, in the form of sand or flint, with sodium carbonate, or with a mixture of sodium sulphate and carbon. The mass is extracted with water and concentrated to the consistency of a viscous syrup. It may also be prepared by heating finely divided silica, such as kieselguhr, with a solution of caustic soda under pressure. On treatment with acids, hydrated silica is precipitated. Water-glass is used for protecting stonework against weathering, in the manufacture of artificial stone, fire-proof cements, soap, &c., and also for preserving eggs.

Waterhouse, Alfred, British architect, born at Liverpool in 1830, died in 1905. He studied architecture in Manchester; was successful in the competition for Manchester Assize Courts, and designed Owens College and the Town Hall there. Among his chief works in London are the Natural History Museum at South Kensington, the New University Club, the National Liberal Club, the New St. Paul's Schools, and the City and Guilds Institute. He partly reconstructed Balliol College, Oxford, and Caius and Pembroke, Cambridge. He was a member of many foreign academies, and was elected R.A. in 1885.

Waterloo′, a village of Belgium, nearly 10 miles S.S.E. of Brussels. It is famous for the battle which was fought there on 18th June, 1815, and which finally shattered the power of Napoleon. The Prussian defeat at Ligny, and his own unsuccessful engagement at Quatre-Bras on the 16th of June, caused Wellington to retire towards Waterloo, while Blücher concentrated his troops at Wavre, about 10 miles distant. The whole British position formed a sort of curve, the centre of which was nearest to the enemy. The French forces occupied a series of heights opposite, there being a valley of no great depth, and from 500 to 800 yards in breadth, between them. Each army probably consisted of about 70,000 men. The troops of Napoleon were for the most part veterans; while Wellington had an army composed of troops of various nationalities (Belgians, Brunswickers, Hanoverians, Nassauers) that had never fought together, and a great part of his British troops (about 25,000) were raw levies. The object of Napoleon was to defeat the British, or force them to retreat, before the Prussians, who, he knew, were coming up, could arrive in the field; while that of the Duke of Wellington was to maintain his ground till he could be joined by his allies, when it might be in his power to become the assailant. The French began the battle about noon, and it continued with great fury till evening, when the appearance on the scene of the Prussians caused Bonaparte to redouble his efforts. His Imperial Guards, which had been kept in reserve, made a final attempt. Wellington's line, however, charged them at the point of the bayonet, and the Imperial Guards began a retreat, in which they were imitated by the whole French army. The British left the pursuit to the Prussians. The whole French army was dispersed and disabled, and their artillery, baggage, &c., fell into the hands of the conquerors. Their loss in killed, wounded, and prisoners amounted to between 40,000 and 50,000. The Allied loss amounted to 23,000 killed and wounded, of whom over 11,000 were British and Hanoverians, 3000 Netherlanders, and 7000 Prussians.

Water-plants, or **Aquatics**, plants which grow partially or entirely submerged in water or floating thereon. Although Algæ are the most thorough-going water-plants, the term is commonly applied more especially to those relatively few Higher Plants that have reverted to aquatic life, such as water-lilies, Potamogeton, duckweeds, Vallisneria, &c. These show many special adaptations, including lack of mechanical tissue, plentiful air-spaces, water-borne seeds and fruits, &c.; their flowers, however, are almost always borne above water.

Water Polo, an aquatic sport, the popularity of which in Britain is attested by the growing number of the clubs devoted to its play; numbering but fifty in 1886, they had increased to six hundred in the first years of the present century. Official control is vested in the Amateur Swimming Association. A swimming-bath, the water being at least 3 feet in depth, affords a suitable ' field '. The width should not be more than 20 yards, and the length between goals from 20 to 30 yards. The ball is a little over 2 feet in circumference. Seven players form a side, and play lasts for two periods of seven minutes each. The possibilities of giving 'fouls' are numerous.

Water-power. See *Energy, Physical*; *Hydraulics*; *Hydro-electric Engineering*; *Nitric Acid*; *Power Transmission*; *Rainfall*; *Turbine, Water*.

Waterproof Cloth, cloth rendered impervious to water. There are numerous processes for waterproof fabrics of all kinds. The earliest patent, that of Macintosh (1823), consisted in covering cloth with a paste obtained by dissolving caoutchouc in benzol or coal naptha. In the treatment of cotton and linen cloth a small proportion of sulphur is generally added. A thin layer of this rubber solution is spread on the fabric by special machinery, after which the cloth is doubled, pressed, and finished in calenders, the waterproof layer being thus in the centre of the finished material. Textiles thus manipulated become also impervious to air, and from a hygienic point of view unsuitable for prolonged personal wear. This led to the introduction of other solutions and methods of application intended to produce fabrics which, while resisting rain, do not altogether obstruct ventilation. Consecutive dipping of cloths in soap and alum solutions, or in gelatine and gall solutions, or in a solution of acetate of lead and then in a solution of alumina, has been resorted to with more or less success. The substance called algin, obtained from sea-weed, has also been strongly recommended for the same purpose. There are also used for heavy fabrics solutions of paraffin wax and ceresine in benzene or petroleum benzene, ammoniacal solutions of various metals, and various sulphates and chromates of metal, as well as aluminium acetate, ammonium cuprate, and pitch or tar. A later patent process consists in treating the fibres in the solution instead of the manufactured textile, and the fabric thus produced, while rain-resisting, offers the same ventilation as ordinary materials.

Water Rights. There is no right of property in running water, but the owner of land over or through which water flows in a natural stream has the right of use as it passes, but must allow it to pass on to the neighbouring lands over or through which it flows not only in its proper channel but also in undiminished quantity and in unimpaired quality, except in so far as he has gained a prescriptive or other right to divert, diminish, or pollute it. If he uses the water in such a way as wrongfully to injure other interests, he is liable in an action of damages. But a proprietor who properly conducts mining operations on his own land and thereby drains away underground water from his neighbour is making a lawful use of his own property and is not liable in damages. A grant of water conveys the rights of fishing and navigation, but not of property in the ground on which the water is. For the latter purpose it is necessary to convey the land itself, and a grant of land includes the water on it without express reference. A *prima facie* prescriptive right to a watercourse is acquired after twenty years' uninterrupted enjoyment, and an indefeasible right after forty years, but in the case of a navigable river not so as to defeat the rights of the public to use it for navigation.

Water-scorpion, the popular name of Nepa, a genus of hemipterous insects, the species of which inhabit ponds, &c. Some of them are powerful forms, 2 or 3 inches in length. They receive their popular name from the scorpion-like shape of the forelegs, with which they seize their prey.

Water-spout, a remarkable meteorological phenomenon frequently observed at sea. It is caused by the passage over the water of a whirlwind, which may have had its origin over a land surface. There is thus an ascending column of air rotating rapidly round an axis. Centrifugal force produces a partial vacuum in the centre. At the outside the ascending contained moisture is condensed to form a thick black cloud rotating round the axis with vertical motion. When this funnel-shaped column passes near the surface of the sea, the vacuum draws up into the vortex the sea-water, which joins in the whirling motion. The whole column, which after the junction extends from the sea to the clouds, assumes a magnificent appearance, being of a light colour near its axis, but dark along the sides. When acted on by the wind, the column assumes a position oblique to the horizon, but in calm weather it maintains its vertical position, while at the same time it is carried along the surface of the sea. Sometimes the upper and lower parts move with different velocities, causing the parts to separate from each other, often with a loud report. The whole of the vapour is at length absorbed in the air, or it descends to the sea in a sudden violent downfall of rain. What are sometimes called *water-spouts on land*, or *cloud-bursts*, are merely heavy falls of rain of a very local character that occur generally during thunder-storms.

Water Supply. See *Dam*; *Reservoir*; *Plumbing*.

Watertown, a city of New York, United States, the county seat of Jefferson county, on the Black River; served by the New York Central & Hudson River Railway. Incorporated in 1816, it became a city in 1869. Pop. (1920), 31,263.

Watertown, a town of Massachussets, United States, in Middlesex county, on the Charles River; served by the Boston & Maine Railway. Pop. 20,000.

Watertown, a city of Wisconsin, United

States, on Rock River; served by the Chicago, Milwaukee, & St. Paul Railway. Settled in 1835, it was chartered as a city in 1858. Pop. 10,000.

Water-violet (*Hottonia palustris*), an aquatic herb, order Primulaceæ, not uncommon in ponds and ditches in Britain. It has finely divided leaves, and tall aerial scapes with whorls of pretty lilac flowers. See *Heterostyly*.

Watford, a town of England, in Hertfordshire, on the Colne. It has breweries, corn- and paper-mills, &c. The London Orphan Asylum is located there. Pop. (1921), 45,910.

Watson, John, author, better known by his pseudonym of Ian Maclaren, born in 1850, died in 1907. He became a licensed minister of the Free Church of Scotland in 1874, and after short periods of ministerial service at Logiealmond and Glasgow he was chosen in 1880 minister of Sefton Park Presbyterian Church, Liverpool. He resigned this charge in 1905. He published under the pseudonym of Ian Maclaren successful stories and sketches of Scottish life, especially *Beside the Bonnie Brier Bush* (1894).

Watson, Sir William, English poet, was born in 1858. His first volume, *The Prince's Quest and other Poems*, was published in 1880. Four years later he issued his *Epigrams of Art, Life, and Nature*, but it was not till the publication of *Wordsworth's Grave and other Poems* (1890) that he gained adequate recognition from the public. His later volumes include: *Lachrymæ Musarum and other Poems* (1892), *The Eloping Angels* (1893), *The Hope of the World and other Poems* (1898), *For England* (1903), *The Man who Saw* (1917), and *The Superhuman Antagonists* (1919). He was knighted in 1917.

Watt, James, the most celebrated of British mechanical engineers, was born at Greenock in 1736, and died at his seat of Heathfield, Staffordshire, in 1819. His father was a merchant and magistrate of Greenock, and young Watt received a good education there. Having determined to adopt the trade of mathematical instrument maker, he went to London (1754) for instruction, but ill-health compelled him to return after a year's apprenticeship. Shortly afterwards he endeavoured to establish himself in Glasgow, was appointed in 1757 mathematical instrument maker to the university, and resided within its walls till 1763. From this time till 1774 he acted as a civil engineer, and made surveys for canals and harbours, some of his plans being afterwards carried out. It was during this period that he gave shape to his chief improvements on the steam-engine (see *Steam-engines*). In order to produce the improved machine, he associated himself (1775) in business with Matthew Boulton, the firm of Boulton & Watt having their engine-works at Soho, Birmingham. He retired from business in 1800. Watt was a Fellow of the Royal Societies of London and Edinburgh, and member of the National Institute of France. He was twice married, and was survived by one son, who carried on the establishment at Soho in partnership with a son of Boulton. Besides improving the steam-engine, Watt invented or improved a variety of mechanical appliances, including a letter-copying press. He was a man of high mental powers generally, and possessed a wide and varied knowledge of literature and science. A monument by Chantrey was erected to his memory in Westminster Abbey.

Watt, the practical unit of electric power. It is represented by a current of 1 ampere flowing through a circuit whose potential difference is 1 volt, or any current in amperes obtained with a potential difference of its reciprocal in volts. The watt is too small a unit for general use, and is replaced by one a thousand times greater, known as the kilowatt. The number of watts equivalent to 1 h.p. is 746, and consequently a kilowatt is equal to 1·34 h.p. By combination of the power with the time during which it operates, the unit of electrical energy, or kilowatt hour, which is also known as the Board of Trade unit, is obtained.

Watteau (vȧt-ō), Jean Antoine, French painter, born at Valenciennes in 1684, died at Nogent-sur-Marne in 1721. He first worked under Gérin at Valenciennes, where he had the opportunity of studying Rubens and Van Dyck. In 1702 he went to Paris and engaged in decorative work, coming into touch with Claude Gillot and Audran, the keeper of the Luxembourg, where he was able to study Rubens, Titian, and Veronese. His talent once recognized, he rapidly became popular and prosperous. His earliest pictures were mainly of camp and genre scenes, but later he turned to the painting of *fêtes galantes*, that is, pleasure parties, balls, masquerades, and similar subjects, typified by the brilliant *Embarkation for Cythera* (Louvre), the picture painted on his reception into the Academy (1717). Founder of the brilliant Rococo school of eighteenth-century France, Watteau was unequalled by his followers in poetic imaginative power, subtlety of perception, and exquisiteness of handling. The Wallace Collection possesses an unrivalled group of his paintings.

Wattle-bird, an Australian bird (*Anthochæra carunculata*) belonging to the honey-eaters, and so named from the large reddish wattles on its neck. It is about the size of a magpie, and is of bold, active habits.

Wattmeter, an instrument for measuring electrical power. In direct-current working the simple multiplication of the voltage and amperes passing gives the watts in use; but such is not always the case with alternating currents, whose current and pressure may be out of phase (see *Inductance*). The majority of wattmeters have a fixed and a moving coil. One of these is of high resistance, and is connected up as the voltage winding; while the other is of low resistance, and conveys the current or a certain shunted proportion of it. The power is proportional to the torque produced on either coil. The instrument is made direct-reading by having the moving coil provided with an index or needle, and arranged to act against the action of a spring. An instrument of that type may be used for either direct or alternating currents. The most important commercial electrical measurement is the metering of supply to consumers, which is done by watt-hour meters of the integrating type, or, in the case of a direct-current system, sometimes with ampere-hour meters, which are calibrated, by allowing for the supply pressure, in kilowatt-hour or Board of Trade units.

Watts, George Frederick, English artist, born 1817, died 1904. He first exhibited at the Royal Academy in 1837. In 1843 and 1847 he secured prizes of £300 and £500 from the Commissioners for the Decoration of the Houses of Parliament for his *Caractacus* and *Alfred inciting the Saxons to attack the Danes at Sea*; afterwards painting *St. George and the Dragon* for the Parliament Houses, and *The School of Legislation* for Lincoln's Inn. Among his more important pictures are: *Life's Illusion* (1849); *Sir Galahad* (1862); *Ariadne* (1863); *Esau* (1865); *Love and Death* (1877); *Time, Death, and Judgment* (1878); *Happy Warrior* (1884); *Hope* (1886); *Judgment of Paris* (1887); *The Angel of Death* (1888); and *Court of Death* (1902). He was a great idealist, and a subtle and powerful portrait-painter. He presented many of his works to the nation. Watts was also a sculptor of mark.

Watts, Isaac, English theologian and hymn-writer, born 1674, died 1748. In 1702 he became minister of a Dissenting congregation in London, but ill-health compelled him in 1712 to relinquish his pastoral duties, and henceforth he resided at the house of Sir T. Abney, a London alderman, at Newington. His theological works are all forgotten, but his hymns are among the best in English. See *Hymns and Hymn-writers*.

Watts-Dunton, Theodore, English poet, born in 1832, died in 1914. His long connection with the *Athenæum* began in 1875. In 1897 he collected in *The Coming of Love and other Poems* some of the more important of his poetical contributions to the *Athenæum* and other periodicals. *Aylwin*, a novel or romance published in 1898, forms a striking prose counterpart to *The Coming of Love*, and shows intimate knowledge of gipsy life. He is chiefly remembered, however, on account of his friendship with Swinburne, who shared his home for almost thirty years, until his death in 1909.

Wave. The essential features of wave motion are seen in the familiar example of plane surface waves in water. Any particle oscillates about its mean position in a certain *period* T, or with a certain *frequency* f (see *Sound*). In each period the crests of the waves advance through the *wave-length* λ, at a constant speed or *wave-velocity* V. It follows that $\lambda = VT$, and $\lambda f = V$. The height of a surface particle above the mean level is a function of $x - Vt$, where x represents the co-ordinate distance from a fixed origin, and t is the time; for the height at (x, t) must be reproduced at $(x + Vt_1, t + t_1)$, since the wave travels a distance Vt_1 in time t_1. Similarly, when the condition of any medium at (x, t) depends only on the value of $x - Vt$, a plane wave is said to be travelling through the medium in the x-direction with velocity V. In the most important class of cases the conditions are periodic, so that the medium is in the same state in every respect at time $t + T$ as at time t, if T is the period. (No natural motion is strictly of this type, owing to the presence of energy-dissipating forces; these can usually be allowed for by the introduction of a damping factor, say e^{-at}, into the expressions for the disturbance.) Among periodic disturbances the simplest are those of *sinusoidal* type, in which the dependent variable y is given by an equation of the form $y = A \sin n(x - Vt)$. Here y and its derivatives remain unchanged if x is increased by $2\pi/n$, or t by $2\pi/nV$; the wave-length λ is therefore $2\pi/n$, and the period T is $2\pi/nV$, i.e. λ/V.

For surface waves in water, it can be shown that $V^2 = (g\lambda/2\pi) \tanh (2\pi h/\lambda)$, where g is the acceleration due to gravity, and h is the mean depth. This gives, for deep-sea waves, $V^2 = g\lambda/2\pi$; and for long waves in shallow water $V^2 = gh$. The orbit of any particle of the water is an ellipse. For very short waves, the influence of surface tension (see *Capillarity*) becomes appreciable. In this case $V^2 = g\lambda/2\pi + 2\pi T/\lambda\rho$, where T is the surface tension and ρ the density. V is least when the wave-length is $2\pi\sqrt{(T/g\rho)}$. For waves of length less than this, surface tension is more important than gravity; Lord Kelvin called such waves *ripples*.

In an isotropic elastic solid (see *Elasticity*) a disturbance originating at an internal point is propagated in waves of two distinct types: (1) waves of compression and dilatation, with velocity $\sqrt{(k + \frac{4}{3}\mu)/\rho}$ (see *Strength of Materials*); (2) distortional waves, with velocity $\sqrt{\mu/\rho}$; ρ being the density. In a cylindrical rod, three main types of waves are possible—longitudinal, torsional, and flexural. Such waves are intimately related to the *free vibrations* of the solid. The nature of the relation may be illustrated by the simple example of a stretched string or wire. If a string lies along the axis of x when at rest, and if the particle at x is displaced transversely to (x, y) at time t, it is easy to prove that $d^2y/dt^2 = V^2d^2y/dx^2$, where $V^2 = T/\rho$, T being the tension and ρ the mass per unit length. The solution of this equation is $y = f(x - Vt) + F(x + Vt)$, where f and F are arbitrary functions, so that the disturbance consists of two waves travelling in opposite directions with velocity V. As a particular case, $y = A \sin m(x - Vt) + A \sin m(x + Vt)$, or $y = 2A \sin mx \cos mVt$, which represents a simple harmonic vibration (see *Fourier Series*) or, as it is frequently called, a *standing wave*. For an arithmetical method of resolving *any* vibration into its simple harmonic constituents, see G. A. Gibson, *Introduction to the Calculus*. See *Sound*; *Light*; *Ether*; *Wave Theory of Light*; *Wireless Telegraphy*; *Interference*; *Harmonic Motion*; *Harmonics*.—BIBLIOGRAPHY: H. Lamb, *Hydrodynamics*; Lord Rayleigh, *Sound*.

Wavellite, a greenish to colourless mineral occurring usually in radial aggregates in slaty rocks, and composed of hydrous aluminium phosphate. The aluminium phosphate minutely diffused in soils may be of the same nature.

Wave Theory of Light. A wave theory of light was first promulgated by Christiaan Huygens (q.v.) about 1690. It was unable, however, to explain the rectilinear propagation of light in a satisfactory manner, and consequently was not received favourably. For more than a century the field was held by Newton's emission theory, according to which a ray consisted of a jet of small particles. But in 1802 Young discovered the principle of *interference* (q.v.) and greatly improved the wave theory, and in a classic series of memoirs dating from 1816 Fresnel treated the whole field of light from the standpoint of the wave theory in such an effective manner that it found universal acceptance. Fresnel showed that the light waves were transverse, he investigated the properties of the *ether* (q.v.) in which they travelled, and he derived numerical formulæ for the losses at reflection, velocity in a crystal, &c., which have stood the test of the subsequent century in a very satisfactory manner.

According to Fresnel, the ether was a solid body and the light vibrations were analogous to the vibrations of material particles. Various mathematicians attempted to make the matter more precise without much success, until Clerk Maxwell introduced his electromagnetic theory about 1865. According to this theory, we are to think of the light wave as a wave of electric force combined with a wave of magnetic force, these forces being at right angles to one another and to the direction of propagation of the wave. Clerk Maxwell's theory is based on his equations of the electromagnetic field, which play pretty much the same rôle in light and electricity as Newton's law of gravitation does in astronomy. They cannot be put simply; the one set is a generalization of the expression for the magnetic force in the field of a wire carrying a current (Oersted's experiment), and the other is a generalization of the laws of current induction investigated by Faraday. Maxwell's theory was neglected until 1887–8, when Hertz demonstrated in the laboratory the existence of electromagnetic waves of much greater wave-length than light waves; then it was received with enthusiasm.

Maxwell thought of all media as continuous. Towards the end of last century the view was developed that the atom consisted of electrons, small electrically charged particles, which under certain circumstances emitted light waves, and which oscillated under the influence of the light waves when the latter passed over them. This was a continuation of the steady development which had taken place from the time of Fresnel. But presently a difficulty arose. If a rod of carbon is heated, it glows first with a dark heat, then becomes red-hot, orange, and finally white. Carbon approximates to what is known as the theoretical 'black body', a body which would absorb all the light falling on it and reflect none, and the change in the character of the radiation of the black body with temperature and wave-length has been the subject of much study. In a mathematical investigation of the matter Planck found it necessary to assume that light was emitted by the electrons not continuously but in definite quantities or quanta, as he called them, at a time. Each wave-length had its own quantum, the value of the latter being given by $h\nu$, where h is a constant known as Planck's constant and equal to $6{\cdot}55 \times 10^{-27}$ erg sec., and ν is the frequency of a light wave, i.e. the number of crests that pass per second.

Colour of Light.	Wave-length.	Frequency.	Quantum.
Red ..	0·0000650 cm.	$4{\cdot}62 \times 10^{14}$	$3{\cdot}02 \times 10^{-12}$ erg
Green ..	0·0000525 "	$5{\cdot}71 \times 10^{14}$	$3{\cdot}74 \times 10^{-12}$ "
Violet ..	0·0000450 "	$6{\cdot}66 \times 10^{14}$	$4{\cdot}36 \times 10^{-12}$ "

The above table gives the value of the quantum worked out for three wave-lengths in the visible spectrum.

The quantum has also cropped up in other fields. In the production of X-rays, for example, it is found that when the electron in the stream of cathode rays has a quantity of kinetic energy $\frac{1}{2}mv^2$, the maximum frequency of the X-ray generated is given by the relation $\frac{1}{2}mv^2 = h\nu$, and when this X-ray falls on a metal, it may eject another electron which will have a maximum energy equal to the energy of the initial cathode ray. The cathode ray transfers a quantum to the X-ray, and the latter apparently transfers the same quantum whole and undivided to another electron. Now a wave spreads out on all sides from its source and delivers its energy in all directions. If the X-rays spread out by wave motion in all directions, they obviously cannot deliver all their energy to one electron. Hence it has been suggested that X-rays and consequently light cannot be propagated by ordinary wave motion, but by something analogous to Newton's emission with quantities of energy substituted for Newton's particles. Such speculations pass under the name of 'quantum theory of light'; they have never been formulated precisely, and they have found their vogue among chemists and investigators of radioactivity rather than with students of light. They have received wide publicity in the popular scientific press.

The view generally held is that the wave theory is not in need of radical alteration, and that the quantum is a quantity of energy released or absorbed by some internal change in the atom. Larmor has compared it with the energy stored in a compressed spring which is fed by an escapement into a pendulum. The pendulum, like the electron, radiates continuously, but if the spring is fully wound and allowed to run down, energy is always delivered up in the same definite quantities. While little progress has been made towards the elucidation of the quantum itself, a school of physicists has taken it for granted and used it to develop a theory of spectra; work in this field is very active at present.

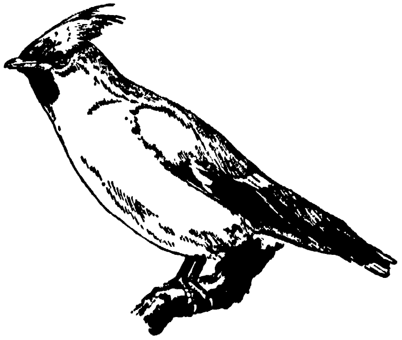
The ordinary wave theory permits of light being propagated in pulses. White light is now regarded as consisting of pulses which are converted into regular harmonic trains by falling on a glass prism; this follows from the work of Gouy and Rayleigh. Such pulses show the phenomena of interference and diffraction. But they spread out equally in all directions, and so do not meet the requirements of the quantum theorists. And the latter have found it quite impossible to explain interference, diffraction, polarization, &c., from their standpoint. See *Quantum Theory*.—BIBLIOGRAPHY: R. A. Houstoun, *Treatise on Light*; E. T. Whittaker, *History of the Theories of Aether and Electricity*.

Wavre, a town of Belgium, in the province of Brabant, on the Dyle; served by rail to Louvain and Charleroi. The town was occupied by the Germans in Aug., 1914. Pop. 8500.

Wax, the name given to various solid substances of animal or vegetable origin, e.g. bees-wax (q.v.) and paraffin (q.v.) wax. Bees-wax is the melissic ester of palmitic acid, and most waxes are esters of monohydric alcohols, being thus distinguished from oils and fats, which are glycerides. In pharmacy, bees-wax occurs in two forms, the white and the yellow, used chiefly for ointments and plasters respectively. The specific gravity of either form is 0·958 to 0·970, and the melting-point 61° to 64° C. Bees-wax is insoluble in water, slightly soluble in boiling alcohol or ether, and readily soluble in hot oil of turpentine.

Wax-engraving, a process for producing blocks for printing in the type press, patented and used by Alfred Dawson in 1872 and called by him typographic etching. The drawing is made upon a metal plate coated with wax with a point generally of steel; when completed the blank spaces between the lines have more wax added, causing the plate to have the appearance of a series of hills and valleys. The plate is then black-leaded and hung in an ordinary electrotyping bath, so that copper is deposited upon the surface. The copper shell so made receives a backing of lead, which after turning and planing is mounted upon a wood or metal block, making with the mount exactly the height of type. The method is used largely in the production of maps and mathematical or other figures which require names or reference letters. These names or letters are stamped into the wax when the drawing is completed, and on reproduction give neater results than ordinary drawn letters. For examples see maps under *Geography*.

Wax-wing (*Ampĕlis garrŭlus*), a perching bird of the family Ampelidæ. It derives its name from the appendages attached to the secondary and tertiary quill-feathers of the wings, which have the appearance of red sealing-wax. The Bohemian wax-wing sometimes visits England. An American wax-wing is the cedar-bird (q.v.).



Wax-wing

Weald, a valley or tract of country lying between the North and South Downs of Kent and Sussex in England.

Wealden Beds, the lowest division of the Cretaceous system in south-eastern England, including the Hastings Sand and the Weald Clay, both of freshwater origin. The lake in which they were formed extended into the Boulonnais area of France, and similar conditions prevailed in Belgium, while the typical marine Neocomian strata were accumulating farther to the south-east. See *Cretaceous System*.

Wealth. Most economists have tried to define wealth, but it is a vague term, and it does not much matter what precise meaning we give to it as long as, for the purposes of any discussion, we adhere to one. Professor Marshall says: "All wealth consists of things that satisfy wants, directly or indirectly. All wealth consists of desirable things, or things that satisfy human wants; but not all desirable things are reckoned as wealth. The affection of friends, for instance, is an important element in well-being, but it is not reckoned as wealth, except by poetic licence." It is customary to use the word in a somewhat different sense when we speak of national wealth on the one hand, and the wealth of an individual on the other. A man's wealth may generally be taken to be his stock of material goods to which he has private property rights, and which he can therefore sell or exchange. These will include not only tangible objects, such as land, houses, furniture, and machinery, but also stocks and shares, and other claims which he may have upon his fellow-men. In addition to these things, the wealth of an individual will include his business and professional connections—'goodwill', and immaterial advantages of that kind; but it is not convenient, as a rule, to include personal qualifications and faculties as wealth, even though these may be productive of wealth, because they are not directly transferable and exchangeable.

When we speak of the wealth of nations, however, we shall have to give a wider interpretation to the term. The national wealth must include that of all the individuals composing it, but, in addition to these, there are collective goods which may make all the difference to the wealth or poverty of the community as a whole. Thus there are in any civilized country roads and canals, public buildings and parks, and other national property of a valuable kind, and more important even than these are those 'free gifts of nature'—the rivers, climate, natural fertility of the soil, &c.—which fundamentally determine the general level of well-being among the inhabitants. It will be obvious, moreover, that although individual faculties and capabilities may be conveniently excluded from the computation of individual wealth, the sum of these qualities in the citizens of a state is a most important factor in the wealth of the state as a whole.

Weasel

Weasel (*Putorius vulgăris*), a digitigrade carnivorous mammal, family Mustelidæ, a native of almost all the temperate and cold parts of the northern hemisphere, and one of the best-known British quadrupeds. It measures about 2½ inches in height, and 7½ inches in length, with a tail about 2½ inches long. The body is extremely slender, the head small and flattened, the neck long, and the legs short. It feeds on mice, rats, moles, and small birds, and is often useful as a destroyer of vermin in ricks, barns, and granaries. The polecat, ferret, ermine, and sable are akin.

Weaver-bird, a name given to birds of various genera, belonging to the Ploceidæ and related to the finches. They are so called from the remarkable structure of their nests, which are woven of various vegetable substances. Some species build their nests separate and singly, and hang them from slender branches of trees and shrubs; but others build in companies, numerous nests suspended from the branches of a tree being under one roof, though each one forms a separate compartment and has a separate entrance. They are natives of the warmer parts of Asia, of Africa, and of Australia. The *Ploceus icterocephălus*, or yellow-crowned weaver, is a native of South Africa.

Weaving, the art of interlacing yarn threads or other filaments by means of a loom, so as to form a web of cloth or other woven fabric. In this process two sets of threads are employed, which generally traverse the web at right angles to each other. The first set extends from end to end of the web in parallel lines, and is commonly called the *warp*; while the other set of threads crosses and interlaces with the warp from side to side of the web, and is generally called the *weft* or *woof*. In all forms of weaving the warp threads are first set up in the loom, and then

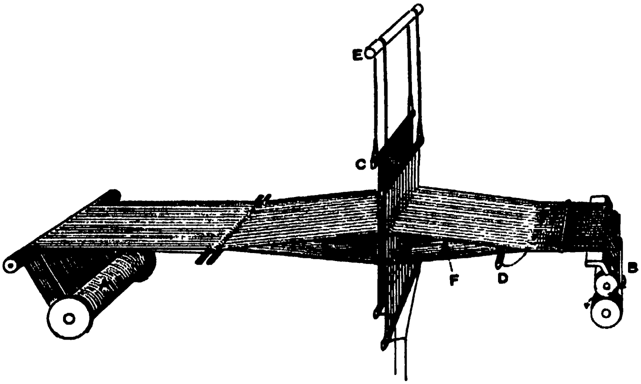


Diagram of Chief Parts of a Hand-loom

A, Warp beam; B, Cloth beam or rollers; C, Heddle shaft; D, Shuttle; E, Pulley or roller for raising and lowering heddles; F, Shed.

the weft threads are worked into the warp, to and fro, by means of a *shuttle*. It was by this fundamental process of interlacing two sets of threads in looms of simple mechanism that the mummy cloths of Egypt, the fine damasks and tapestries of the Greeks and Romans, the Indian muslins, the shawls of Kashmir, and the famed textile fabrics of Italy and the Netherlands were produced. Up to about 1850 practically all weaving was effected by means of the hand-loom. This loom, in its simplest form, consists of a frame of four upright posts braced together by cross-beams, the centre beam at the back being the warp-beam, the beam in front being that upon which the web is wound, while just above this, in front, is the breast-beam over which the woven cloth passes on its way to the cloth-beam. At the top of the loom is an apparatus by which the *heddles* are lifted or lowered by means of connections to the *treadles* under the foot of the weaver. The heddles or *healds* are two frames, between the upper and lower *shafts* of which strings or wires are extended. On each string an eye, or *mail*, is fitted, through which one of the warp threads passes. As these threads are controlled by the frames, alternately, it follows that when one heddle is raised, every second thread in the warp is also raised, while the remaining threads are depressed; and this is called *shedding the warp*. When the warp-threads are thus parted, there is left a small opening or shed between the threads, and it is through this opening that the weaver drives his shuttle from side to side. The shuttle, which is hollow in the middle, contains the weft-thread wound round a bobbin or pirn, or else in the form of a cop on a shuttle tongue, and as the shuttle is shot across the web this weft-thread is drawn from the pirn, bobbin, or cop. When the thread is thus introduced, it is necessary to bring it to its place in the fabric. This is accomplished by means of the reed which is held securely in the *lay* or *batten*; the latter is suspended from the top of the loom, and works to and fro like a pendulum by an attachment of vertical rods at each side called the swords. The reed itself is formed of a number of steel or wire uprights, flattened and fixed in the top and bottom boards. A usual method is to insert two warp-threads in each opening (split or dent) of the reed, although this number is often varied for special purposes. The shuttle was originally thrown across by hand, first with the left and then with the right if the fabric was a narrow one; two weavers would be required for a wide cloth. A great improvement was made upon the hand-loom when John Kay, about 1740, invented the fly-shuttle, as it was called. This enabled the weaver to drive the shuttle both ways with the right hand by means of a cord and picker attached to a box spindle near each end of the shuttle-race, which impelled the shuttle to and fro at each jerk of the cord. For figured fabrics, the draw-loom was used, but Joseph Marie Jacquard's invention of the cylinder,

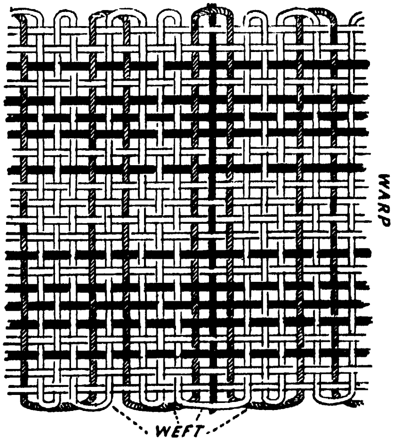


Diagram showing how a simple pattern is woven. The different shading indicates different colour threads which he used in conjunction with parts invented by Falcon and Vaucanson, perfected the loom which now bears his name. This loom is an ingenious arrangement of hooks, wires, and cords, by means of which the warp-threads are lifted in any order and to any extent necessary to make the shedding required by the pattern. The order in which these hooks are successively lifted and lowered is determined by means of a series of pasteboard cards punctured with holes, the holes and blanks corresponding to a certain pattern and the cards passing successively over a cylinder or drum. The needle wires pass through these holes and cause the hooks to be left in position for being lifted, while those pressed back by the needle wires remain down. In this way the raised hooks lift the warp-threads in an order which secures that the arranged pattern is woven into the fabric. When the pattern is extensive, the machine may be provided with as many as 1000 hooks and wires, or even more. Another development was made in the art of weaving by the invention of the power-loom by the Rev. E. Cartwright in 1784. In the power-loom, which has been gradually improved and adapted to water, steam, gas, and electric power, the principal motions of the old method of weaving, such as shedding the warp-threads, throwing the shuttle, and beating up the thread, are still retained. The frame of the power-loom is of cast iron, and motion is communicated to the loom by means of a crank-shaft, the stroke of the lay being made by cranks attached to the driving shaft, while the shuttle is driven across alternately, in general, from side to side, but in various other ways if desired, by a system of cams, levers, picking arms, and connections to the pickers in the box spindle. Although the principle of the loom is more or less the same in all kinds of weaving, yet there are numberless modifications for the production of special fabrics. The lappet loom is one suitable for weaving small effects, resembling embroidery, on a plain cloth or on a gauze cloth. The latter cloth is obtained by a scheme of cross-weaving, in which one set of threads is made to cross from side to side of another set, and held in these crossed positions by the weft. See *Carpet*; *Velvet*.

Weber (vā'bėr), Karl Maria Friedrich Ernst von, German musical composer, born 1786, died 1826. In 1800 he wrote the opera *Waldmädchen* (Wood-maiden), and had it performed at Chemnitz and Freiberg, in Saxony. In 1803 he visited Vienna, where he became acquainted with Haydn and the Abbé Vogler, from whom he received great help in his studies. From 1813 to 1816 he was director of the opera at Prague. At the close of 1816 he settled at Dresden, where he was founder and director of the German opera. In 1820 he went to Berlin to bring out *Der Freischütz*, the most celebrated of his compositions. It was performed in London and Paris two years later. In 1822 *Euryanthe* was produced on commission for Vienna, and was brought out there in Aug., 1823. In 1826 Weber visited London to superintend the production of *Oberon*, which he had composed for Covent Garden Theatre. It was enthusiastically received. Besides the operas mentioned, Weber wrote a large number of other works.—Cf. Sir Julius Benedict, *Weber*.

Weber, Wilhelm Eduard, German physicist, born 1804, died 1891. For most of his life he was professor of physics at Göttingen. Weber played a prominent part in the earlier development of electrical science, on the theoretical as well as on the practical side, and did a great deal to establish the system of absolute electrical units. The name *Weber* is sometimes used for the practical unit of magnetic flux, or 10^8 C.G.S. units.

Webster, Daniel, American statesman, born in 1782 at Salisbury, in New Hampshire, died in 1852. In 1836 (and again in 1848) he was an unsuccessful candidate for the presidency. In 1841, under the presidency of General Harrison, he was appointed Secretary of State, and he had an important part in the arrangement of the Ashburton Treaty of 1842. He was opposed to the admission of Texas as a slave state and to the Mexican War, but supported Clay's 'compromise' of 1850. In 1850 he succeeded General Taylor as Secretary of State for Foreign Affairs under President Fillmore. A collection of his speeches, State papers, and correspondence was published at Boston the year before his death.—Cf. G. T. Curtis, *Life of Daniel Webster*.

Webster, John, English dramatist, was writing plays between 1602 and 1624. To write a biographical notice of Webster is as easy as it is to write on the ophiology of Iceland. Apart from the uninspiring fact that he was a tailor, we know nothing of his life. We do not know when he was born or when he died. During his apprenticeship as a dramatist he wrote only in collaboration. He collaborated with Middleton and others in two plays, *Cæsar's Fall* and *The Two Harpies*, and assisted Dekker, Heywood, and Wentworth Smith to write *Lady Jane*. The former two plays are lost; but *Lady Jane* is usually identified with *The Famous History of Sir Thomas Wyat*, an invertebrate play which bears many traces of the hand of Dekker and none of the hand of Webster. Webster had some share in the second edition of Marston's *Malcontent* (1604), but it is probable that his sole contribution was the induction, a work of little merit. The two citizen comedies *West-Ward Hoe!* and *North-Ward Hoe!* were both written in conjunction with Dekker.

The former probably induced Jonson, Chapman, and Marston to write *Eastward Hoe!* (1605), which in its turn prompted the production of *North-Ward Hoe!* These plays were written in friendly rivalry, not in enmity; and Dekker's and Webster's two plays are good and vigorous, though not equal to *Eastward Hoe!* There is much evidence to show that Webster was a careful and deliberate workman; collaboration, therefore, did not suit him, and he reserved his strength for his original work. During the next period of his work Webster wrote his two great tragic masterpieces, of which the earlier is *The White Divel* (also known as *Vittoria Corombona*). This play was printed in 1612, and was probably written in the previous year. The source of its plot has caused some investigators considerable trouble. The play is founded on fact, and the events on which it is based took place between 1581 and 1585. No account of these events has been found which corresponds exactly with the version given by Webster. It is probable that the alterations which Webster introduced were for the purpose of making the play more effective on the stage, just as Shakespeare altered Cinthio when writing *Othello*. Webster's object was to make a powerful tragedy, not to satisfy meticulous historians. He has completely attained his object. This play is masterly. It is a sublimation of the tragedy of revenge as written by Kyd and, at a later date, by Tourneur. The other masterpiece of Webster, *The Dutchesse of Malfy*, is, if anything, more masterly. It is based on an old story, which is probably alluded to by Malvolio in *Twelfth Night*, II, v, 45 (" the lady of the Strachy married the yeoman of the wardrobe "). This play was probably written about 1613, though not printed until 1623. It is a riper play than its great predecessor, and is probably the greatest non-Shakespearean tragedy of Elizabethan times. In these two plays Webster shows himself to have complete mastery over all forms of pity and terror, and to be able to raise melodrama to the plane of tragedy. Webster's other plays include: *The Guise* and *A Late Murther of the Sonne upon the Mother* (with Ford), both lost; *The Devil's Law-case*, an unequal play in which purple patches are sewn on some veritable fustian; *Appius and Virginia*, a play which is meritorious rather than masterly; and *A Cure for a Cuckold*, a mixture of rough farce and romantic comedy. He has also been credited or debited with the authorship of *The Thracian Wonder*, a play in which he had no share. The usual elegy on Henry, Prince of Wales, a few occasional poems, and a city-pageant, *Monuments of Honor* (1624), comprise the rest of Webster's extant works. Webster's fame rests almost entirely on his two masterpieces. In them he has shown himself to be nearest to Shakespeare among the Elizabethans, and, as Domitius Afer said of Virgil, he is " propior primo quam tertio ". His work shares with that of Shakespeare the quality of inevitableness; the characters of other playwrights *might* have spoken as they do; those of Shakespeare and Webster *must* so have spoken. Webster is an apt pupil of Shakespeare's; not in the letter which killeth, but in the spirit which giveth life. —BIBLIOGRAPHY: A. C. Swinburne, *The Age of Shakespeare*; R. C. Brooke, *John Webster and the Elizabethan Drama*; E. E. Stoll, *John Webster: the Periods of his Work.*

Webster, Noah, lexicographer, born at West Hartford, Connecticut, in 1758, died in 1843. He chose the law as a profession, but relinquished it for teaching (1782). About the same time he began the compilation of school-books, and published his *Grammatical Institute of the English Language*. In 1806 he published an 8vo English dictionary, which led the way for his great work, the *American Dictionary of the English Language*. The first edition of his dictionary was published in 1828 (2 vols. 4to). It contained nearly 40,000 more definitions than had appeared in any previous English dictionary.

Wedgwood, Josiah, British potter, born at Burslem, in Staffordshire, in 1730, died in 1795. He received little education, and went to work in his brother's factory at the age of eleven. He removed for a time to Stoke, where he entered into partnership with persons in his own trade, and where his talent for ornamental pottery was first displayed. Returning in 1759 to Burslem, he set up a small manufactory of his own, in which he made a variety of fancy articles. His business improving, he turned his attention to white stoneware, and to the cream-coloured ware for which he became celebrated. His reproduction of the Portland Vase is famous. His improvements in pottery created the great trade of the Staffordshire potteries.

Wedgwood-ware, a superior kind of semi-vitrified pottery, without much superficial glaze, and capable of taking on the most brilliant and delicate colours produced by fused metallic oxides and ochres; so named after the inventor. It is much used for ornamental ware, as vases, &c., and, owing to its hardness and property of resisting the action of all corrosive substances, for mortars in the laboratory. See Frontispiece to Vol. IX.

Wednesbury, a municipal borough of Staffordshire, England, in the Black Country, an important seat of wrought-iron and steel manufactures of the most varied kinds. It has an ancient church, town-hall, art gallery, free library, &c. Pop. (1921), 30,407.

Wednesday, the name of the fourth day of the week (in Lat. *dies Mercurii*, day of Mercury), derived from the old Scandinavian deity Odin or Woden.

Week, a period of seven days, one of the common divisions of time, the origin of which is doubtful. Among the nations who adopted the week as a division of time, the Chinese, Hindus, Egyptians, Chaldæans, Jews, Persians, and Peruvians have been mentioned, but in some cases the antiquity of the practice is doubtful, and in others the name has been applied to other cycles than that of seven days. The nations with whom the weekly cycle has been traced with certainty to the greatest antiquity are the Egyptians and the Hebrews. With the former we only know of its existence, but with the latter it had a much more important character. The use of the week was introduced into the Roman Empire about the first or second century of the Christian era from Egypt, and had been recognized independently of Christianity before the Emperor Constantine confirmed it by enjoining the observance of the Christian Sabbath. With the Mahommedans the week has also a religious character, Friday being observed by them as a Sabbath.

Weever, a name of several spiny-finned fishes of the genus Trachinus, family Trachinidæ. Two species are found in the British seas, viz. the dragon-weever, sea-cat, or sting-bull, *T. draco*, about 10 or 12 inches long, and the lesser weever, *T. vipĕra*, called also the adder-pike, or sting-fish, which attains a length of 5 inches. They inflict wounds with the spines of their first dorsal fin, which are much dreaded.

Weevil, the name applied to small beetles of the family Curculionidæ, distinguished by the prolongation of the head, so as to form a sort of snout or proboscis. Many of the weevils are dangerous enemies to the agriculturist, destroying grain, fruit, flowers, leaves, and stems. The larva of the corn-weevil (*Calandra granaria*) is very destructive to grain, that of the pea-weevil (*Bruchus pisi*) to peas. The name is also incorrectly given to the little biscuit beetle (*Anobium paniceum*), family Ptinidæ.

Weierstrass, Karl, German mathematician, born 1815, died 1897. He was professor of mathematics in Berlin from 1864, and through his lectures there exercised an extraordinary influence on the development of modern mathematics. The characteristics of his work are the rejection of geometrical intuition as a proper basis for analysis, and the foundation of the science on the principles of pure arithmetic. His achievements in this field, and his discoveries in many branches of analysis, more especially in the calculus of variations, elliptic functions, and function theory generally, mark him out as one of the greatest of mathematicians.

Weight. See *Gravity*; *Dynamics*.

Weights and Measures. The chief British units of length, volume, weight, and time are discussed in the articles *Foot, Inch, Yard, Chain, Mile*; *Bushel, Gallon*; *Avoirdupois, Troy Weight, Pound, Ton*; *Day, Week, Month, Year*. For physical units see *Dynamics, Foot-pound, Horse-power, Work, Density, Ampere, Farad, Ohm, Volt, Watt, Inductance*. A unit of heat has recently been introduced called the therm; it is equivalent to 100,000 British Thermal Units (see *Calorimetry*).

In the *metric system* the standard units are: the *metre* = 39·37 inches, or $1\frac{3}{32}$ yards, nearly; the *gramme* = 15·432 grains; and the *litre* = 61·022 cubic inches, or 0·880 imperial quart. Larger or smaller units are derived from these by successive multiplications or divisions by 10. Thus, in the series kilometre, hectometre, decametre, metre, decimetre, centimetre, millimetre, each unit is 10 times the following unit. The prefixes are Greek and Latin forms indicating the relationship to the metre. The same prefixes are used with *gramme* and *litre* in the tables of weight and capacity. Thus, roughly, 1 kilogramme = 1000 grammes = 2·2 pounds; and 1 kilometre = 1000 metres = $\frac{5}{8}$ mile. See *Are*.

Weihaiwei, a territory of North China in Shantung. It comprises a maritime zone 10 miles wide on the coast of the Shantung Peninsula and the Island of Liukung as well as all those in the Bay of Weihaiwei; total area 285 sq. miles. Weihaiwei was leased to Great Britain in 1898 as a naval station, and the region east of 121° 40′ E. long., with an area of 1505 sq. miles, came automatically under British protection. There is a coast-line of 72 miles. Pop. (1921), 154,000.

As a result of the settlement of the "Shantung Question" by the Washington Conference (q.v.) Britain made arrangements to return Weihaiwei to China, subject to certain conditions.

Weimar (vī′mär), the capital of Thuringia, on the Ilm, in a beautiful valley surrounded by hills. Weimar is closely associated with the names of Schiller, Goethe, Herder, and Wieland, the first three of whom are buried there. Pop. (1919), 37,237.

Weinheim, a town of Baden, Germany, on the Weischnitz; a junction for Fürth and Lampertheim and the Weinheim-Mannheim railway, on the Frankfurt-am-Main–Heidelberg line. There are leather-works and a machine-shop; a mineral spring and bath. Pop. 15,000.

Weismann, August, German biologist, born in 1834, died in 1914. His first book of note was *Studies in the Theory of Descent* (1875–6). The most important of his subsequent works are: *Essays upon Heredity and Kindred Biological Problems* (1889–92), *Germ Plasm* (1893), *The Omnipotence of Natural Selection* (1893), *Fresh*

Thoughts on the Question of Heredity (1895), *On Germinal Selection* (1896), *Lectures on the Theory of Descent* (1902), and *The Evolution Theory* (1904). Weismann was a strong supporter of the natural selection theory, but he is specially known by his theories on the question of heredity. He explained heredity by the continuity from generation to generation of the so-called germ-plasm, and on this basis denies the possibility of inheriting acquired characters. See *Evolution*; *Heredity*.

Weissenburg, a noted spa of Switzerland, in the canton of Bern, in the Lower Simmental; served by the Spiez-Zweisimmen Railway. The mineral spring has a temperature of 80° F.

Weissenburg-am-Sand, a town of Bavaria; served by the Munich-Hof Railway. Silver and gold, lace, and beer are made. There is a mineral spring and bathing establishment. Pop. 10,000.

Weissenfels, a town of the Prussian province of Saxony, on the Saale; served by rail to Zeitz, Berlin, and Lebra. Shoe-making is the staple industry. Pop. 40,000.

Welding, the process of joining together metal parts by introducing new metal between them in such a way as to make a complete metallic structure. The ordinary process of smithing is the primitive form, and one that is largely used with the few materials that are suited to it. For the formation of structures in wrought iron, heating and hammering gives adequate strength in the joints, and the process is one in which an ordinary workman can be trained to excel. With the more complicated work of modern times, the necessity has arisen for the production of welds cheaply on materials which cannot be smithed. One of the most important processes is the use of an oxygen-acetylene flame for melting down a wire or rod of metal into a pool made by the heating of the parent metal where the junction is to be made. Other gases than acetylene have also occasionally been used along with oxygen, such as hydrogen, coal-gas, and blue water-gas. A flame akin to that of a Bunsen burner is obtained and gives a sufficient temperature for the melting process. Electricity has also been used for the purpose of welding in many different ways, such as by the arc, or by the heating effect of the passage of current through the metals at their proposed junction. Electric arc welding has had a considerable extension from the period of the European War, when its use was advocated in order to leave the available supplies of acetylene for the purpose of cutting heavy steel plates in the shipyards and engineering-works. The process is one of creating an electric arc between a carbon or a metal rod and the parts which are to be welded together. The carbon process is much used in filling holes in heavy castings. Metallic arc welding can, with care, be performed quite satisfactorily with a bare electrode, as is commonly the case in America, but for the better protection of the molten metal it has been customary in this country, and to a certain extent on the Continent, to cover the electrode with a flux material which melts and forms a slag over the work. The coverings used are blue asbestos in association with an aluminium wire surrounding the metal to be melted down, as in the Quasi Arc process; or mixtures of various metallic salts. Alternating or direct current can be used for the process, which requires a pressure of 60 to 100 volts to start the arc. The current can be restricted to that suited to the work by resistances or by the automatic voltage regulation of the machine to meet the arc requirements. When alternating currents are used regulation is commonly obtained by combinations of transformers with choking coils. Arc welding has been extended in use to most ferrous metals, and to a limited extent to the non-ferrous ones. Resistance welding in continuous runs or 'spots' has been applied to very thin material, and is much used in drum-making and for other sheet-metal purposes. The alternating current supply is taken to a transformer the secondary circuit of which consists of one or two turns and is completed by the work. In that way large currents at low pressures are obtained. Tram rails and heavy castings are frequently welded by the Thermit process, in which iron is produced in the liquid state by heating a mixture of aluminium powder and iron oxide by a special igniter powder.

Wellesley, Richard Colley, Viscount and Marquess, and Earl of Mornington, British administrator, eldest son of Garrett, first Earl of Mornington, and eldest brother of the Duke of Wellington, born 1760, died 1842. Educated at Eton, and at University College Oxford, he took his seat as Earl of Mornington in the Irish House of Peers (1781), and three years after was returned to the British House of Commons. The appointment of Governor-General of India was conferred upon him in 1797, and he was created Marquess Wellesley (Irish peerage) in 1799. His administration forms an era in the history of the British Indian Empire. He returned to England in 1805, and in 1809 became Foreign Secretary under Perceval. In 1812 he resigned, chiefly because he was in favour of Catholic emancipation. He did not return to office till 1822, when he became Lord-Lieutenant of Ireland. This post he retained till 1827. In the Grey ministry he again (1833) became Lord-Lieutenant of Ireland, but finally retired from public life in 1835.—BIBLIOGRAPHY: W. H. Hutton, *Marquess Wellesley*; *The Wellesley Papers*, by the editor of *The Windham Papers*.

Wellingborough, a town of Northamptonshire, on the Nene. The principal industries are the manufacture of boots and shoes, and the smelting of iron. Pop. (1921), 20,365.

Wellington, first Duke of. Arthur Wellesley or Wesley (he used the latter spelling until he was in his thirtieth year) was the fourth son of the first Earl of Mornington, and was born on or about 29th April, 1769, was educated at Eton, and, at the age of eighteen, obtained a commission as ensign in the 73rd Foot (now the 2nd Battalion of the Black Watch). Until the outbreak of war with France in 1793, he seemed likely to have a career as an 'ornamental' soldier, being aide-de-camp to the Lord-Lieutenant of Ireland and a member of the Irish Parliament. In 1794–5 he saw service in Flanders, and in 1797–8 in India, and gained distinction in both campaigns. The great opportunity of his life came with the appointment of his brother, Lord Mornington (afterwards Marquess Wellesley) to the Governor-Generalship of India in 1798, for the elder brother recognized the abilities and trusted the judgment of the younger. After the capture of Seringapatam, he was made governor of the town, and he proved himself a capable military administrator in Mysore. His name first became known to the general public in 1803, when, in the second Mahratta War, he won, at Assaye, the first great battle gained under his own independent command, and received the thanks of Parliament. In 1805 he returned to England as Major-General Sir Arthur Wellesley, and, after some home service, became member of Parliament for Rye and Chief Secretary to the Lord-Lieutenant of Ireland. During his tenure of that office (1807–9) he took part in the expedition to Copenhagen in 1807, was again thanked by Parliament, and promoted to the rank of lieutenant-general. In the following year the British Government determined to send an expedition to drive the French out of Portugal and to co-operate with an anti-French rising in Spain, and the command was given to Wellesley, who landed near Oporto in the summer of 1808, with the intention of relieving Lisbon. At Vimeiro, on 21st Aug., he won the first great success on land which had fallen to British arms in the war, but he was immediately superseded automatically by the arrival of two senior officers, who granted the beaten army an armistice and made the Convention of Cintra for the evacuation of Portugal by the French. All three commanders were recalled to appear before a court of inquiry, and Sir John Moore was left to conduct the campaign. After the death of Moore and the embarkation of his army at Corunna, Wellesley was sent in command of a new and larger expedition to the Spanish Peninsula, where, from 1809 until 1814, he conducted a brilliant series of military operations, by which he ultimately drove the French out of Spain. The campaign was marked by a series of victories, the most famous of which were Talavera (1809), for which Wellesley was raised to the peerage as Viscount Wellington; the successful defence of the lines of Torres Vedras during the winter of 1810–1; Salamanca (1812), when " 40,000 men were beaten in 40 minutes "; Vittoria (1813); and the Pyrenees (1813–4). The early operations were very difficult, and Wellington's military conduct was at times subjected to fierce and ungenerous criticisms at home; but he had the support of the Government, and was created first Earl and then Marquess of Wellington in 1812, a field-marshal in 1813, and Duke of Wellington in 1814.

After Napoleon's escape from Elba in 1815 and his restoration to the throne which he had abdicated in the preceding year, Wellington (who in the interval had been British Ambassador at Paris and a plenipotentiary at the Congress of Vienna) was placed in command of the British army and of some allied forces of Dutch, Belgians, and Germans, which assembled in Belgium to co-operate with the Prussians under Blücher, and also with the Russians and the Austrians when they should arrive. Napoleon resolved to attack before Russian and Austrian troops could reach Belgium, and hoped to be able to defeat Wellington and Blücher separately. Separate actions were fought with the Prussians at Ligny (a French victory) and with the British at Quatre Bras on 16th June, 1815, but, in the final and sternly contested battle of Waterloo (18th June), a Prussian force under Blücher came up in time to render valuable assistance to Wellington's troops, which had been engaged for some hours.

After his last and greatest victory, the Duke of Wellington commanded the army of occupation in France until 1818, and took part in the Congress of Aix-la-Chapelle. On his return home he was made Master-General of the Ordnance, with a seat in Lord Liverpool's Cabinet, and he became one of the leaders of the Tory party. While advocating reactionary and repressive measures at home, he sympathized with Canning's policy of non-intervention in the affairs of Turkey, Italy, and Spain, but disapproved of his recognition of the independence of the South American Republics which revolted from Spain, and of the support given to the Greek cause at Navarino. In Jan., 1827, he became Commander-in-Chief of the army, but resigned this office and the Master-Generalship of the Ordnance when Canning became Prime Minister in April. On Canning's death in August, he again became Commander-in-Chief, and after the fall of the Goderich Cabinet in Jan., 1828, he became Prime Minister. His Toryism made it impossible for him to work with the followers of Canning, and his ministry became purely Tory, but he was compelled by events to carry a measure (of which he personally disapproved) for the removal of Catholic disabilities. His Government continued to oppose the demand for Parliamentary Reform, and was defeated in Nov., 1830. Wellington continued to be the leading opponent of the Reform Bill, but in the crisis of 1832 he advised the Opposition peers to absent themselves from the House of Lords, and so permitted the Bill to pass. During this period he was violently unpopular, and the windows of Apsley House, his London home, were twice broken by a mob; he kept them closed with iron shutters for the rest of his life. Except for four months in 1834–5, Wellington never again took political office, but he sat in Peel's second Cabinet (1841–6) as minister without portfolio, and he held the Commandership-in-Chief (which he had resigned on becoming Prime Minister) from 1842 until his death, and showed his aversion to change in military as well as in political affairs. He died suddenly on 14th Sept., 1852, at Walmer Castle, his residence as Warden of the Cinque Ports, and was buried in St. Paul's Cathedral. Except during the Reform crisis, Wellington occupied an unexampled position of authority and influence in the country, and the death of the 'Iron Duke' was felt to be the passing of a national institution. His private character and disposition was hard and unamiable, and it has been said that "the more one reads of Wellington, the more one respects him and the less one likes him".—Bibliography: Lord Roberts, *The Rise of Wellington*; Sir Herbert Maxwell, *Life of Wellington*; G. R. Gleig, *Personal Reminiscences of the 1st Duke of Wellington.*

Wellington, a town of England, in Shropshire, with manufactures of farm implements, brass and iron ware, &c. Pop. (1921), 8148.

Wellington, a town of England, in Somerset, with manufactures of woollens. From this place the Duke of Wellington took his title. Pop. (1921), 5811.

Wellington, the capital of New Zealand, situated on Port Nicholson, an inlet of Cook's Strait, on the south-west extremity of the provincial district of Wellington, North Island. The principal buildings are the Government House, the Houses of Legislature, the Government Buildings, and the Supreme Court. Pop. (1921), 107,488.—The provincial district of Wellington has an area of 10,807 sq. miles. It is subject to earthquakes, but has a mild and equable climate; mean annual temperature at Wellington (142 feet altitude), 55° F. (January, 62·5°; July, 47·5° F.); rainfall, 50·5 inches (fairly equally precipitated all the year round). Pop. (1921), 248,800.

Wells, Herbert George, British novelist and social thinker, born at Bromley, Kent, 1866. The son of a professional cricketer, he was at first employed in a drapery shop, but was able, by means of scholarships he had won, to study science. In 1888 he graduated with honours at London University, and for several years taught biology. In 1893 he turned to journalism and literature, contributing to *Nature* and *The Saturday Review*. His first work, *Select Conversations with an Uncle*, appeared in 1895. Interested in many subjects, science, sociology, and theology, Wells produced, besides novels dealing with the lower middle classes, works on socialism, politics, history, and theology, and a series of romances which contain sociological and scientific forecasts. It is, however, as a writer of romance, and not as a philosopher, historian, theologian, or even sociologist, that Wells will be remembered. As a novelist he ranks high, although he has not created any types of humanity. The quantity of his output has doubtless detracted from its quality. His works include: *The Time Machine* (1895), *The Invisible Man* (1897), *The War of the Worlds* (1898), *Love and Mr. Lewisham* (1900), *Anticipations* (1901), *Mankind in the Making* (1903), *A Modern Utopia* (1905), *Kipps* (1905), *New Worlds for Old* (1908), *Tono-Bungay* (1909), *Ann Veronica* (1909), *The History of Mr. Polly* (1910), *The New Machiavelli* (1911), *Marriage* (1912), *Mr. Britling Sees it Through* (1916), *God the Invisible King* (1917), *Joan and Peter* (1918), *The Undying Fire* (1919), *An Outline of History* (1920), *Secret Places of the Heart* (1922). Cf. A. W. Gomme, *Mr. Wells as Historian.*

Wells, a city of England, in Somersetshire. United with Bath it gives the title to a bishop's see. It contains one of the most magnificent cathedrals in England, 415 feet long, with a transept measuring 155 feet; a central tower 155 feet, and two western towers each 126 feet high. Pop. (1921), 4872.

Welsbach Burner. When certain salts of the rare earths are heated to a high temperature they become incandescent, giving off a very white light (see *Gas Manufacture*). This was recognized by Welsbach, who made gas-mantles of these materials and heated then with Bunsen burners. Modern mantles are made of cotton, ramie, or artificial silk. An asbestos loop is used to bring the top together and serve as a means of support. After dipping the thread is burned out, and the oxide of thorium produced by heating. The mantle is then shaped and finally dipped in a stiffening solution, such as gun-cotton dissolved in alcohol and acetone.

Welshpool, a municipal borough of Wales (Montgomery district), largest town in Montgomeryshire, on the Severn. It carries on the woollen manufacture. Pop. (1921), 5677.

Welwitschia (wel-wich'i-a), a remarkable plant growing in Southern Africa in dry regions near the western coast, between lat. 14° and 23° s. It presents a stem or rhizome forming a woody mass rising to a foot at most above the ground, and having a diameter of from 4 to 5 inches to as many feet, this mass bearing the two original cotyledonary leaves, which, when they reach their full development of 6 feet in length or so, become dry and split up into shreds but do not fall off. Every year several short flower-stalks are developed at the base of these leaves, but no other leaves are produced. There seems to be but one species, *W. mirabilis.* It is placed among the Gnetales.

Wen, an encysted tumour occurring on the scalp or other parts of the body. They are formed by the accumulation of sebum in a hair follicle, or in the recesses of the sebaceous gland of the hair sac, causing distension of the sac. An encysted tumour, in its commencement, is always exceedingly small, and perfectly indolent; and it is often many years before it attains any great size. The best mode of treatment is complete removal of the whole swelling by dissecting it out.

Wends, the general designation used by Germans for a section of the Slavonic race dwelling in Lusatia, and comprising the Sorbs and the Polabs, dwelling between the Elbe and the Oder. In the sixth century the Wends were a powerful people, and occupied the country from the Elbe and the Saale on the west to the Bober on the east. Cut off from contact with the other Slavs and completely surrounded by Germans, the Wends, numbering about 200,000, are now mostly germanized, and the Lusatian-Wendish speech is rapidly disappearing. There is, however, a Wendish national movement, and in 1919 the heads of the movement appealed to the Peace Conference and asked for self-determination.

Wenlock, a municipal borough of England, in Shropshire. It comprises Much Wenlock, Broseley, Madeley, Coalbrookdale, &c. There are large iron and other industries. Pop. (1921), 13,712.

Wenlock Series, in geology, the middle division of the Upper Silurian system lying immediately below the Ludlow rocks, and so called from being typically developed on Wenlock Edge.

Werdau, a town of Saxony, on the Pleisse; served by the Leipzig-Hof Railway. Machines and automobiles are made, and with iron-founding, wool and cotton dyeing and spinning, form the principal industries. Pop. 22,000.

Werden, a town of Rhineland, Germany, on the Ruhr; served by rail to Essen. Wool-spinning, weaving, and dyeing, glass-blowing, brewing, and boot and cloth manufacturing are the main employments. Pop. 13,000.

Werewolf (from A.S. *wer*, a man and *wolf*, cf. Gr. λυκάνθρωπος; Lat. *versipellis*; Ger. *währwolf*; Fr. *loup-garou*), a man temporarily transformed into a wolf. The idea that such a transformation was possible seems to have been common to all Europe, and still lingers in Brittany, Serbia, and parts of Russia. Herodotus (*Melpomene*, 105) says that the Neuri are sorcerers, and that each Neurian changes himself once in the year into the form of a wolf, and continues in that form for several days. Ovid in his *Metamorphoses* (i, 163 *seq.*) tells the story of Lycaon, whom Jupiter transformed into a wolf. Pliny (*Nat. Hist.* viii, 22) relates how on the festival of Jupiter, Lycæus, one of the family of Antæus, was selected by lot, and brought to the brink of the Arcadian lake. He then hung his clothes on an oak and plunged into the water, whereupon he was transformed into a wolf. Nine years after, if he had not tasted human flesh, he was permitted to resume his human shape. Virgil (*Eclogues*, viii, 97) mentions one Mœris, who became a wolf and hid himself in the woods. In the *Satiricon* of Petronius Arbiter, Niceros, a freedman, tells (§ 61) a realistic story of a werewolf: when the wolf was wounded in the neck, the man was found in bed with a wound in the same place. Apuleius (*Metamorphoses*, ii, 22) says that witches " change their skin and turn themselves at will into sundry kinds of beasts, whereby they deceive the eyes even of the Sun and of very Justice; sometimes they are transformed into birds, sometimes into dogs and mice, and sometimes into flies ". Bodin says that the Royal Procurator-General once shot a wolf, and that the arrow had stuck in the beast's thigh. A few hours after, the arrow was extracted from the thigh of a man lying wounded in bed. At Vernon, in 1566, witches and warlocks assembled in great numbers in the shape of cats. Some men were attacked by them and wounded several of them; next day a number of wounded women were found in the town. In the British Isles, since there are no wolves, witches take the shape of hares and cats; but it was not so always. Gervase of Tilbury writes: " Vidimus enim frequenter in Anglia per lunationes homines in lupos mutari; quod hominum genus *gerulphos* Galli nominant, Angli vero *were-vulf* dicunt ". Richard Verstegan in his *Restitution of Decayed Intelligence* (1605) says: " The werwolves are certayne sorcerers, who having annoynted their bodies with an oyntment which they make by the instinct of the devill, and putting on a certayne inchaunted girdle, doe not onely unto the view of others seeme as wolves, but to their owne thinking have both the shape and nature of wolves, so long as they weare the said girdle. And they do dispose themselves as very wolves, in wourrying and killing, and most of humane creatures." Epistemon, in the *Dæmonologie* of King James VI and I, does not believe in "war woolfes"; for he says: "There hath indeede beene an olde opinion of such like things; for by the *Greekes* they were called λυκάνθρωποι, which signifieth men-wolfes: But to tell you simply my opinion in this, if any such thing hath beene, I take it to haue proceeded but of a naturall super-abundance of Melancholy, which as we reade, that it hath made some thinke themselves pitchers, and some horses, and some one kinde of beast or other, so suppose I that it hath so viciat the imagination and memory of some, as *per lucida interualla*, it hath so highly occupied them, that they haue thought themselues very Woolfes indeed at these times: and so haue counterfeited their actions in going on their hands and feete, preassing to deuoure women and barnes, fighting and snatching with all the towne dogges, and in vsing such like other brutish actions, and so to become beasts by a strong apprehension, as Nebuchadnezzar was seuen yeeres." See *Lycanthropy.*—Cf. S. Baring-Gould, *A Book of Were-Wolves.*

Wernigerode, a town of Prussia, on the Holzemme, at the foot of the northern versant of the Harz Mountains; junction for Nordhausen, on the Heudeber-Harzburg Railway. Sawmilling, dye-stuffs, brewing, and the making of agricultural machinery and photographic material are the chief employments. Pop. 20,000.

Wesel (vā′zl), a river-port in Rhenish Prussia, at the confluence of the Rhine and Lippe, both spanned by bridges, 30 miles N.N.W. of Düsseldorf. Manufactures include soap, wire, and cement. Pop. 24,440.

Weser (vā′zėr), a river of Germany, formed by the junction of the Fulda and Werra at Münden, flows generally in a north-west direction, and, after a very circuitous course, traverses the city of Bremen, and then falls by a wide mouth, very much encumbered with sand-banks, into the North Sea. Its length, including the Werra, is about 430 miles. The navigation for vessels of large size ceases at Bremerhaven.

Wesley, Charles, English hymn-writer, younger brother of John Wesley, born at Epworth 1708, died in 1788. Educated at Westminster School, and Christ Church, Oxford, he accompanied his brother to Georgia as an ordained clergyman in 1735–6, but soon after his return to England he became a preacher in the Methodist connection, and materially assisted the success of the movement by his numerous hymns, large collections from which have been frequently published.

Wesley, John, the founder of Wesleyan Methodism, was born at Epworth, Lincolnshire (his father being rector of the parish), 17th June, 1703, died 2nd March, 1791. Educated at the Charterhouse, and at Christ Church, Oxford, he took his degree of B.A. in 1724; was ordained deacon in 1725; became a Fellow of Lincoln College, and lecturer and moderator in classics in 1726; and took priest's orders in 1728. He then gathered together a number of pupils and companions who met regularly for religious purposes, and by so doing acquired the name of Methodists. Among these companions were Hervey, Whitefield, and Law, the author of *A Serious Call to a Devout and Holy Life.* In 1735 Wesley accepted an invitation from General Oglethorpe to go out to America to preach to the colonists of Georgia. After a stay of two years he returned to England (Feb., 1738), and in the following May an important event took place in his life, namely, his conversion. In June he paid a visit to Herrnhut, the Moravian settlement, returning to England in September. Early in the following year (1739) he began open-air preaching, in which he was closely associated with Whitefield, from whom, however, he soon separated, but without a permanent personal breach. Having now the sole control of the religious body which adhered to him, he devoted his entire life without intermission to the work of its organization, in which he showed much practical skill and admirable method. His labours as an itinerant preacher were incessant. He would ride from 40 to 60 miles in a day. He read or wrote during his journeys, and frequently preached four or five times a day. He married in 1750 Mrs. Vazeille, a widow with four children, but the union was unfortunate, and they finally separated. He held strongly to the principle of Episcopacy, and never formally separated from the Church of England. His collected works were published after his death in thirty-two vols. 8vo. He contributed to the collection of hymns, the greater part of which was written by his brother Charles. See *Methodists.*—BIBLIOGRAPHY: C. T. Winchester, *Life of John Wesley*; W. H. Fitchett, *Wesley and his Century*; *The Journal,* edited by N. Curnock; F. J. Snell, *Wesley and Methodism*; R. Southey, *Life of Wesley.*

Wessex, the district of England which includes the modern counties of Berkshire, Hampshire, Wiltshire, Dorset, and Somerset. It represents the ancient kingdom of the West Saxons, about the origin of which there has been considerable controversy. The older view, that the West Saxon invaders entered the country by Southampton Water and made their first capital at Winchester, has been challenged by writers who trace the earliest West Saxon settlements to the Thames Valley, with an early capital at Dorchester (in Oxfordshire). The West Saxons, having brought the British in Devon and Cornwall under their rule, began to hold a leading place among the English kingdoms, and after the fall of Mercia, in the end of the eighth century, Wessex attained the hegemony in England. Its great King Egbert (802–839) established the power of Wessex over the whole south of England and over East Anglia by the victory of Ellandune (the locality of which is doubtful) in 825, and subsequently extended his supremacy over Mercia and Northumbria. The leadership thus acquired was retained by his descendants, though the power, and even the existence, of Wessex was placed in grave jeopardy by the Danish invasions, which became serious about the time of Egbert's death. His son, Ethelwulf, his four grandsons, Ethelbald, Ethelbert, Ethelred I, and Alfred the Great, and his great-grandson, Edward the Elder, were the leaders of the English in the long, and ultimately successful, struggle with the Danes. In the course of the conflict, the royal families of the other English kingdoms became extinct, and Edward the Elder was acknowledged as the King of all England. His descendants occupied the English throne until the death of Edward the Confessor in 1065, except for the period of the later Danish invasions (1016–42). The blood of the old English or West Saxon House was brought into the Norman royal family by the marriage of Henry I to the daughter of the Saxon princess Margaret who was the wife of Malcolm III of Scotland. Until after the Norman Conquest, Winchester, the capital of Wessex, was the capital of England, and English history in the ninth, tenth, and eleventh centuries is the history of Wessex.

West, Benjamin, English painter, born at Springfield, Pennsylvania, in 1738, died in London in 1820. He visited England in 1763, and was so well patronized that he determined to make it his future residence. He painted *Hector and Andromache*, *The Return of the Prodigal Son*, and an historical painting of *Agrippina*, the last for the Archbishop of York, who introduced him to George III. The latter became his steadfast patron, and gave him commissions to the extent of about £1000 a year for upwards of thirty years. On the death of Reynolds, in 1792, West was elected president of the Royal Academy.

West Africa, a general term used mainly in the political sense to include certain British and French colonies. British colonies are: Gold Coast (including Ashanti), Sierra Leone, Nigeria, and Gambia. French West Africa is sometimes considered as the whole of the west of that continent, north of the equator, that belongs to France. French colonies are: Ivory Coast (see *Konakry*), Upper-Senegal-Niger (French Sudan), Senegal, Upper Volta, and Dahomey. Portuguese Guinea is in West Africa, but Portuguese West Africa is Angola (q.v.). Togoland is now politically non-existent. Liberia is an independent state. Articles on all the above colonies, &c., should be consulted. See also *Africa*; *Geography* (section II, A. 4); *Colony*; *French Congo*; *Angola*; *Guinea*; *Volta* (river); *Senegal* (river); *Niger* (river); *Ashanti*; &c. — BIBLIOGRAPHY: *Peace Handbook No. 90*, *British West Africa* (general); *Peace Handbook No. 100*, *French West Africa*; both published by H. M. Stationery Office, and dealing with the political history, social and political conditions, government, &c., of the region.

West Bromwich, a municipal borough of Staffordshire, England. It is the centre of a mining and manufacturing district, and has grown largely of late years. Pop. (1921), 73,761.

Westbury, an ancient town of Wiltshire, England, on a plain, 21 miles north-west of Salisbury; with manufactures of woollen cloths. Pop. 3700.

Westcott, Brooke Foss, born in 1825, died in 1901. He was assistant-master at Harrow (1852–69), residentiary Canon of Peterborough (1869–83), regius professor of divinity at Cambridge (1870–90), Canon of Westminster (1883–90), and in 1890 he succeeded Lightfoot in the see of Durham. The revision of the Greek text of the New Testament occupied him and Dr. Hort for twenty-eight years, and resulted in the publication of their important work, *The New Testament in the Original Greek*, in 1881. This text formed the basis of the Revised Version of the New Testament.

West Derby, a parliamentary division of Liverpool, forming a wealthy residential suburb of the city. Pop. 149,000.

Western Australia, the largest and most westerly state of the Australian Commonwealth, bounded on the east by an arbitrary frontier lying along the 129th parallel of E. long; area, 975,920 sq. miles; pop. (1921), 332,218 (177,013 males).[1]

Physical.—There is a coast-line of 4350 miles, representing one mile of seaboard to 224 sq. miles of hinterland. Westralia[2] is generally a vast undulating plateau (1000 to 2000 feet altitude), a region of internal drainage, with low, rounded hills separated by broad, shallow valleys, and bounded by steep scarps that in places assume the form of hills, as in the Darling range (Mount William, 2500 feet), known in various sections under different names, and running parallel to the west coast at a distance from it of from 18 to 20 miles. Other ranges are: the Stirling range (Bluff Knoll, 3640 feet); Russell range, between Esperance Bay and Israelite Bay; and the Kimberley ranges (Mount Hann, 2800 feet), mountains of Cambrian, Silurian, and Devonian rocks, trending from north-west to south-east, and fringed by a belt of Carboniferous rocks. Mount Bruce (4025 feet) is possibly the culminating point of all the Westralian mountains. Coastal rivers are more or less short and turbulent, and include, from south to north, the Swan, Greenough, Murchison, Gascoyne, Ashburton, Fortescue, Fitzroy, Drysdale, and Ord.[1]

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[1] Full-blooded aboriginals are estimated to number 25,587 (13,611 males) out of a Commonwealth total of 58,771, and of the former number some 10,000 are out of touch with civilization. There are 1475 half-caste aboriginals and about 5580 full-blood Asiatics out of a non-European population of 7282 (1624 being half-caste and the rest full-blood).

[2] The term *Westralia* is not official. It was coined by Professor J. W. Gregory as a convenient abbreviation, and is used as such here.—Cf. *Geographical Journal*, vol. xlviii (1916), note to p. 331.

Climate.—In the south-west the climate is one of the finest in the world, and may be represented by Perth (197 feet altitude), which enjoys a mean annual temperature of 64° F. (July, 55°; February, 74°) and a mean annual rainfall of from 33 to 34 inches. The highest temperature recorded is 108·4° F., and the lowest 34·2° F. Albany (pop. 4000), also in the south-west, has a mean annual rainfall of 36·7 inches. Coolgardie (1389 feet altitude) has a mean temperature of 64·4° F. (January, 77°; July, 51°) and a rainfall of 9 inches (1·3 inches in May). Broome (63 feet altitude), in the north-west, has a temperature of 80° F. (January, 86°; July, 70°), rainfall 23 inches; Wyndham (23 feet; on Cambridge Gulf in the far north), 85° F. for the year (November, 90°; July, 76°), rainfall 28 inches; and Nullgara (1265 feet; in Pilbarra gold-field in the north-west), 76·5° F. for the year (January, 90°; July, 59°), rainfall 12·7 inches. See climate and physical maps under *Australia.*

Production.—Westralia is chiefly important for its minerals, among which gold takes pride of place, followed by coal and silver (as a by-product of lead). Out of a total Commonwealth gold-production of 1,742,589 oz. during the period 1911–20, Westralia's output amounted to 1,067,080 oz. There are large deposits of iron ore. Minerals produced in small quantities include: stibnite (the chief ore of antimony), tantalum, scheelite (one of the chief ores of tungsten), molybdenite, manganese (black oxide existing in Kimberley region), cobalt (around Norseman and Kanowna), asbestos, arsenic, tin, alunite, graphite, magnesite, and some precious and semi-precious stones (tourmalines, garnets, emeralds, &c.). Guano deposits exist on Abrothos Island, off the coast, near Geraldton. Almost inexhaustible gypsum-deposits are located on the shores of Lake Austin, and large quantities are known to exist at Lake Seabrook. Of a total of 8496 miners in 1920, 7087 were engaged in the mining of gold. Westralia is the least developed commercially and industrially of all Australian states.[2] The pearl and pearl-shell fishing dates from 1850, and has its headquarters at Broome, on Roebuck Bay, in the Dampier division. Agriculturally, the state is progressive, wheat yielding an average of 9 bushels to the acre, oats 12 bushels, and barley 11 bushels. Wine-growing and the production of raisins and currants, as well as fruit-growing (nectarines, apples, oranges, pears, plums; and bananas, lemons, and apricots in smaller quantities), are developing rapidly. In the dry region of the plateau, &c., the water-supply presents a problem which is partially solved by the use of Artesian water.[3] For flora see *Australia.* Woods include the jarrah, karri, salmon gum, tuart, and wandoo.

Government, &c.—Settled in 1829 as the Swan River Settlement, Westralia became a penal settlement in 1850, and remained such until the abolition of transportation in 1868. Responsible government followed in 1890, and in 1900 the colony became a state of the Australian Commonwealth. The administration is vested in a Governor appointed by the King and assisted by a Cabinet of Ministers. There is a bicameral Legislature consisting of a Legislative Council (30 members, elected from 10 electoral provinces for six years) and a Legislative Assembly (50 members from 50 constituencies, elected for three years). Members of both Houses have free passes over the Government railways, and receive payment at the rate of £400 per annum. The capital city is Perth. Boulder (pop. 8220), Bunbury (4500), Geraldton (4000), and Albany

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[1] As already noted, the Plateau is a region of internal drainage, and a prominent physical feature is its lake-system, which, on the map, is clearly defined; but in reality it comprises a series of basins or depressions which, after heavy rains, may form very shallow lakes, although more generally they become large salt-marshes, and in the dry season are mere pans with muddy, salt-encrusted, clay bottoms. There are upwards of 190 of these 'lakes', which have been shown by Gregory and others to be of fluviatile origin, and to represent the last vestiges of some proto-historic river-system which, during a period of desiccation, was broken up into a series of basins of internal drainage. The Plateau itself is an uplifted peneplain. During Miocene times it underwent base-levelling of its rivers, and was uplifted about 1000 feet during Pliocene times. The lake-system affords proof of the fact that, at some remote period, Westralia was much better watered than it is to-day, and it is thought that a period of desiccation followed the uplift, which caused a diminution in internal rainfall. The Miocene river-system was then broken up by the inability of its streams to keep their channels free from the invading sand-dunes, and the remnant of these rivers remains in the Westralian lake-system of to-day. Another theory supposes the Westralian lakes to be inlets from some tidal sea, i.e. to be marine, instead of lacustrine and fluviatile.—BIBLIOGRAPHY: J. W. Gregory, *The Lake System of Westralia* (map and bibliography), *Geographical Journal*, vol xliii (1914), pp. 656–64; and *The Central Lakes of Westralia and the Westralian Peneplain*, *Geographical Journal*, vol. xlviii (1916), pp. 326–31, and note on p. 514.

[2] The Northern Territory is not a state, but a Territory of the Commonwealth.

[3] See note *Artesian Basins* under *Queensland.* Westralia has five such basins, viz. the Carnarvon or North-West Basin, between Burton and Murchison Rivers; the Broome or Gulf Basin, in the far north; the Desert Basin, between Fitzroy and de Grey Rivers; Perth Basin, between Dongarra and Cape Leeuwin, upon which Perth and Freemantle largely depend for their water-supply; and the Eucla Basin, lying along the south coast east of Israelite Bay.

(4000) are important towns. Protestant religious denominations in order of importance are: Anglican (by far the chief), Methodist, Presbyterian, and Congregationalist. Roman Catholicism is the second religion in numerical strength, coming after, but much behind, the Church of England.

Railways.—There was, in 1921, a total mileage of 4906, of which 454 miles represented part of the Kalgoorlie-Port Augusta section of the Trans-Australian Railway, Federal property, and on the 4-ft.-8½-in. gauge. State railways had a mileage of 3540, all of 3-ft-6-in. gauge. See *New South Wales* and *South Australia*, under *Communications.*

West Ham, a county borough of Essex, England, and part of Greater London, about 4 miles E.N.E. of St. Paul's. It returns four members to Parliament. Pop. (1921), 300,905.

Westhoughton, an urban district and parliamentary division in Lancashire, 5 miles W.S.W. of Bolton; with manufactures of silk and cotton, and coal-mining. Pop. (1921), 15,593.

West Indies, an archipelago extending between the coast of Florida on the north and the Venezuelan seaboard on the south, and separating the Atlantic Ocean on the east, from the Caribbean Sea and the Gulf of Mexico on the west. The group is sometimes known as the Antilles, and is divided into Greater and Lesser Antilles. The former includes the islands of Cuba, Jamaica, Haiti, and Porto Rico; and the latter is divided into Leeward and Windward groups. To the north are the Bahamas, and in the south Trinidad and Tobago. See *Colony*; *Leeward Islands*; *Windward Islands*; and articles on groups, islands, towns, &c.

Westland, a provincial district of the southern island of New Zealand, is bounded by the provinces of Canterbury, Nelson, and Otago, and by the Pacific Ocean. It is a long narrow strip about 200 miles in length, with an average breadth of 30 miles, and has an area of 4881 sq. miles. Considerable quantities of gold have been obtained. Among other minerals are coal, lead, silver ore (galena), copper, iron, and tin. The capital is Hokitika. Pop. (1921), 14,181.

Westmeath, a county of Ireland, in the province of Leinster, with an area of 434,665 acres. The surface is hilly in the north, but elsewhere undulates gently. The drainage is shared between the Shannon and the Boyne. The former, with its expansion Lough Ree, forms the western boundary of the county; other rivers are the Brosna and the Inny; and there is a group of large loughs. The principal grain-crop is oats, but the larger part of the available surface is devoted to grazing. Important means of communication are furnished by the Shannon, the Royal Canal, and a branch of the Grand Canal. Westmeath was severed from Meath (q.v.) in 1543. The county town is Mullingar. Pop. 59,986.

Westminster, a city and metropolitan borough of London. Within the city area are Westminster Hall (see *London*), Westminster Abbey, the Houses of Parliament, royal palaces, chief Government buildings, &c. Westminster had a royal residence as early as the time of Edward the Confessor, and derives its name from the Minster (the Abbey), which was called 'west' to distinguish it from the Minster occupying the site of modern St. Paul's. The Manor of Westminster was a de Mandeville possession at the time of Domesday, but subsequently passed to the Davieses, and then to the Grosvenors, who possess the modern ducal title. Among interesting features of the borough are its parks: St. James's, Hyde Park, and Green Park. The first (91 acres) dates in its present form from the reign of George IV; the second (338 acres) was formed by Henry VIII in 1536, and was a royal hunting-ground in the time of Elizabeth and a racing centre under Charles I. The Rotten Row (i.e. 'Route du Roi'—the King's drive) is a fashionable riding-enclosure at the present day. The Green Park (60 acres) adjoins St. James's Park, and Buckingham Palace overlooks them both. Whitehall is the home of Government offices, and meets at Charing Cross the spacious thoroughfare of the Mall, which runs down in a perfectly straight line to the massive memorial to Queen Victoria that stands before the main gate of Buckingham Palace. On the right are Marlborough House and St. James's Palace, on the left St. James's Park. St. James's Palace, founded about 1188 as an hospital for lepers, was bought and raised to the dignity of a palace by Henry VIII, and was the town seat of sovereigns from Anne to William IV. Marlborough House dates only from 1710, when it was built by Wren for the Duke of Marlborough. It was purchased by the Crown in 1817, and is now town house of the Prince of Wales. Buckingham Palace occupies the site of the seats of the Dukes of Buckingham. It was planned in the reign of George IV and completed by William IV, and was first occupied by Queen Victoria, who went there in 1837. The palace gardens cover some 40 acres. The Houses of Parliament extend along the river from Westminster Bridge and face Westminster Abbey. A feature is the clock-tower housing 'Big Ben', a four-faced clock, each face being 233 feet in diameter. A central tower surmounts the great octagonal hall from which Commons, Lords, and St. Stephen's Chapel may be entered.

Westminster Abbey, the coronation church of the sovereigns of England, and one of the chief ornaments of London, is a magnificent Gothic pile, situated near the Thames, and adjoining the Houses of Parliament. In 1065 a church was built here in the Norman style by Edward the Confessor. Part of this structure still remains in the pyx-house and the south side of the cloisters; but the main building, as it now stands, was begun in 1220 by Henry III (who built the choir and transepts), and was practically completed by Edward I. Various additions, however, were made (including the nave and aisles, the west front, and the Jerusalem Chamber) down to the time of Henry VII, who built the chapel which bears his name, while the upper parts of the two western towers were designed by Sir C. Wren. The extreme length of the church, including Henry VII's chapel, is 531 feet; breadth of transepts, 203 feet; height of the roof, 102 feet; height of towers, 225 feet. The coronation ceremony takes place in the choir, where the 'coronation stone' brought away by Edward I from Scotland is placed beneath the seat of the king's coronation chair. Westminster Abbey is distinguished as the burial-place of numerous English kings from Edward the Confessor to George II; the north transept is occupied chiefly by monuments to warriors and statesmen; the Unknown Warrior (q.v.) lies in the nave; while in the south transept is situated 'Poets' Corner', the burial and memorial place of most of England's great writers from Chaucer to Browning and Tennyson.—Cf. M. Sturgeon, *Westminster Abbey*.

Westminster Assembly of Divines, a celebrated assembly held at Westminster for the settlement of a general creed and form of worship throughout Great Britain. By an ordinance passed 12th June, 1643, 121 clergymen, with ten lords and twenty commoners as lay assessors, were nominated as constituents of the assembly. The assembly held its sittings from 1st July, 1643, till 22nd Feb., 1649. Among the results of its deliberations were the *Directory of Public Worship*, the *Confession of Faith*, and the *Larger* and *Shorter Catechisms*, which remain practically the standards of the Presbyterians to the present day. At the Restoration the whole proceedings of the Westminster Assembly were annulled as invalid.

Westminster Hall, the hall of the old palace of Westminster, was erected by Richard II (1397-9) on the foundations of a structure built by William Rufus and completed in 1097. It has a fine porch, and its hammer-beam roof of carved timber is considered the most notable of its kind. Much of the wood of this roof was eaten away by the tunnelling larvæ of the death-watch beetle (*Xestobium tessellatum*), and the roof was restored and reinforced with steel between 1914 and 1923. The length of the building is 290 feet, breadth 68 feet, and height 110 feet. This building is closely associated with many stirring events in English history; but it is chiefly remarkable as the place where were held such great State trials as those of the Chancellor More, Lady Jane Grey, the Earl of Strafford, King Charles I, and Warren Hastings, and as the centre of the highest English courts of law till these were removed in 1883 to the new buildings erected for their accommodation. The hall now serves as a fine vestibule to the Houses of Parliament.

Westminster School, or St. Peter's College, Westminster, one of the great public schools of England, was founded in 1560, and was reorganized in 1868. There are forty foundationers, the number of vacancies yearly being ten. Among the famous headmasters of Westminster School were Nicholas Udall, Dr. Busby, and James Gow. Among its famous pupils were Ben Jonson, Dryden, Warren Hastings, and Gibbon.

Westmorland, a county in England, bounded by Cumberland, Lancashire, Morecambe Bay, Yorkshire, and Durham; area, 504,917 acres. The surface, with the exception of a small portion in the south sloping to Morecambe Bay, is very mountainous. The Pennine Chain, entering it at Cross Fell on its northern frontier, stretches across it in the north-east, and then curves round, forming the boundary between it and Yorkshire; while the principal chain of the Cumbrian Mountains forms its boundary from Helvellyn (3118 feet) to Bow Fell (2959 feet), and sends a lofty branch nearly across its centre. Much of the celebrated lake-scenery of England is within the limits or on the borders of this county, the chief lakes being Ullswater, Grasmere, Rydal Water, and Windermere. The principal rivers are the Eden, Lune, and Kent. The minerals include graphite, roofing-slate, marble, and small quantities of coal, lead, and copper. The arable land is mostly confined to the valleys, while the greater part of the remaining surface is in natural pasture, or under wood. Appleby is the county town. Pop. (1921), 65,740.

Weston-super-Mare, a seaport and watering-place in England, in the county of Somerset, on the Bristol Channel. It is recommended as a place of resort both in winter and summer. Pop. (1921), 31,653.

Westphal Balance, an apparatus used for finding the specific gravity of milk. The essential part is a steel yard, with ten notches on the longer side. To find the specific gravity of any milk, a quantity is mixed and poured into a glass cylinder, the plummet hanging from the end hook being completely immersed in it. The largest rider is hung on the hook, and the other riders are adjusted on suitable notches until the pointer indicates equilibrium, when the specific gravity is read off by counting one for the rider on the hook, and the second, third, and fourth decimal places for the notches carrying the second, third, and fourth riders respectively. The milk sample is tested at 60° F., or a correction must be made in the reading.

Westphalia, (Ger. *Westfalen*), a western province of Prussia, Germany; area, 7807 sq. miles; pop. 4,488,115 (see *Prussia*). It consists of a part of the North German Plain centring at Münster (the capital), and enclosed by the hills of the Teutoburger Wald and the Sauerland, and by the Rhine Valley on the west. Navigable streams include the Ruhr, Lippe, Weser, and Ems. Westphalia is chiefly noted as the locus of the Ruhr coal-basin, and is one of the most highly industrialized regions on the face of the earth. After coal, iron is next in importance. Zinc, lead, antimony, salt, and mercury are also mined. Manufactures include linens and textiles generally (Bielefeld, Herford, Warensdorf, &c.), sugar, paper, glass, chemicals (especially sulphuric acid), and pottery; but iron and steel is the paramount manufacture, centring on Essen and embracing whole towns, such as Bochum, Dortmund, Hagen, Siegen, Lüdenscheid, and Altena.

West Point, the Sandhurst of the United States, the military academy of the United States army. It occupies a reservation of some 8500 acres on the right bank of the Hudson River, in Orange county, New York State, and is served by the West Shore Railway. An officers' academy was established there in 1794, but was reconstituted more or less in its present form by President Jefferson during 1802.

Westport, a seaport of Ireland, county of Mayo, at the mouth of a small river in Clew Bay. It is a favourite bathing-resort, and has a trade in agricultural produce. Pop. 3700.

West Virginia, a state in the South Atlantic division of the United States. It is entirely inland, and is bounded on the west for some 8000 miles by Ohio River, from which the surface rises eastwards to the Alleghany Mountains, a massive, rugged, limestone plateau drained almost entirely to the Ohio. In the north-east is a valley zone drained mainly to the Potomac. A thin, northward extension of the state between Pennsylvania and Ohio is known as the Panhandle. Charleston is the state capital; other towns are Wheeling (pop. 56,200), Huntington (50,200), and Parkersburg (20,000). There are over 10,000 miles of railways, and transport on the Ohio is highly developed. Although the state may be classed as primarily an agricultural one, it is also the second producer of minerals in the United States, and its vast coal-field, tapped by rail and river, covers an area of over 17,000 sq. miles, and produced 78,125,000 tons of coal in 1920. There are also extensive petroleum and natural-gas resources. Manufacturing industries are important. Besides the ordinary cereal crops, hay, roots, &c., West Virginia produces apples, grapes, peaches and plums, and a large amount of tobacco. Dairying and sheep-farming are progressive. Of a total population of 1,463,701 (1920), 86,345 were negroes, and 61,906 were aliens (14,000 Italians, 3800 Germans, 3400 English, and 1500 Irish). Roman Catholic, Presbyterian, Methodist, and Baptist are the chief religious denominations. Primary instruction is compulsory between the ages of eight and fourteen years, and is free at all ages from six to twenty-one. The West Virginia University is located at Morgantown. State area, 24,170 sq. miles (148 sq. miles being water).

West Virginia, formed in 1862 from the western portion of the state of Virginia, was admitted to the Union in 1862. There are 55 counties. The Legislature is bicameral, comprising a Senate (30 members, elected for four years, one-half seeking biennial re-election) and a House of Delegates (94 members, elected for two years). Two Senators and 6 Representatives are sent to Congress.

Westward-Ho, a sea-bathing place of England, in the county of Devon, on Barnstaple Bay, about 3 miles north-west of Bideford. Westward-Ho College is a military school, celebrated as the school described in Kipling's *Stalky and Co.*

Wetzlar, a town of Rhenish Prussia, at the junction of the Lahn and Dill. It was anciently a free imperial town, and was the seat of the imperial German court of justice from 1698 to 1806. Pop. 12,500.

Wexford, a maritime county of the Irish Free State, in the province of Leinster, bounded by Wicklow, St. George's Channel, the estuary of the Suir and Barrow, Waterford Harbour, Kilkenny, and Carlow; area, 580,950 acres. The chief inlet on the east coast is Wexford Harbour, which, though spacious, is of intricate navigation and obstructed by a bar. The surface of the interior is hilly, rising into a ridge on the north-west, declining into a level peninsula to the south-east. The chief rivers are the Slaney and Barrow. The prevailing soil is stiff clay, generally well cultivated, and producing oats, wheat, barley, and potatoes. The fisheries are extensive. Pop. 102,273.

Wexford, the county town of Wexford, Irish Free State, a seaport on the River Slaney, where it enters Wexford Harbour. The town has a county court-house, town hall, prison, theatre, barracks, and a Roman Catholic college. The herring and salmon fisheries employ many persons; malt is manufactured, and distilling, brewing, and shipbuilding are carried on. The chief trade is in exporting grain, cattle, poultry, and butter. Pop. 12,000.

Wexiö, or **Vexiö**, Southern Sweden, in the län of Kronoberg; served by the Alfvesta-Carlskrona Railway, &c. It is a cathedral town, the seat of a bishop, and has iron-founding, brewing, and match-making industries. Pop. 9000.

Weyman, Stanley John, English novelist, born in 1855, was educated at Shrewsbury School, and Christ Church, Oxford, where he graduated in 1877. Called to the Bar in 1881, he practised for a time. In 1890 he began his literary career by an historical romance entitled *The House of the Wolf*. His reputation was first secured by his brilliant story of the French Huguenots, *A Gentleman of France* (1893). His later novels, mainly historical, include: *Under the Red Robe* (1894), *My Lady Rotha* (1894), *The Red Cockade* (1895), *The Man in Black* (1896), *Shrewsbury* (1897), *Count Hannibal* (1901), *The Abbess of Vlaye* (1904), *Starvecrow Farm* (1905), *Chippinge* (1906), and *The Great House* (1919).

Weymouth and Melcombe-Regis, a seaport and municipal borough of Dorsetshire, England. Weymouth is on one side, Melcombe-Regis on the other of the small river Wey, over which is a bridge. There is a considerable coasting trade, the chief export being Portland stone. Melcombe-Regis attracts numerous visitors both in summer and winter, owing to its bathing facilities and mild winter climate. There is a large traffic with the Channel Islands. There is a fine esplanade. Pop. (1921), 24,570.

Greenland or 'right' Whale (*Balæna mysticētus*)

Whale, the common name given to the larger mammals of the order Cetacea (q.v.). They are characterized by having fin-like anterior limbs, the posterior limbs being absent, but having their place supplied by a large horizontal caudal fin or tail. Their abode is in the sea or the great rivers, and they resemble the fishes so closely in external appearance that even some of the earlier zoologists regarded them as belonging to that class. The Balænidæ and Balænopteridæ, or whalebone whales, are distinguished by the absence of teeth, and by the presence of baleen or whalebone in the mouth. The typical representative of the Balænidæ is the common Greenland or 'right' whale (*Balæna mysticētus*), so valuable on account of the oil and whalebone which it furnishes (see *Blubber*; *Whalebone*). It principally inhabits the Arctic seas, but it is also found in considerable numbers in many other parts of the world. Its length is usually about 60 feet, and its greatest girth of body from 30 to 40 feet. The plates of baleen serve to strain out from the water taken into the mouth the pteropoda or other small creatures on which these large animals chiefly subsist. The nostrils open on the top of the head, and are known as 'blowholes'; through these air from the lungs is expired, but water is not ejected in the act of 'blowing' or 'spouting'. The Balænopteridæ include the rorquals, distinguished by a smaller head, furrowed throat, and the possession of a dorsal fin (see *Rorqual*). Of the Physeteridæ, which have no baleen plates, and are also known as 'toothed whales', the best-known species is the sperm-whale or cachalot (*Physēter macrocephălus*), which averages from 50 to 70 feet in length (see *Sperm-whale*). This family also includes the smaller beaked whales (Ziphius, Hyperoōdon, &c.). Some species of the Delphinidæ or dolphin family are also known as whales (see *Beluga*; *Caaing-whale*). Whale fishing for the sake of the oil and whalebone was an important industry even in the twelfth century. It was for long prosecuted with great energy by the Dutch, English, French, and Americans, but in recent times it has greatly decreased, chiefly on account of the scarcity of whales. The instruments used are the harpoon and the lance. The harpoon is an iron weapon about 3 feet in length, terminating in an arrow-shaped head. This is attached to a line, and is thrown at the whale by hand, so as to pierce it, or is discharged from a small swivel cannon placed in a boat. The lance is a spear of iron about 6 feet in length, with a thin sharp steel head. These, with the necessary lines, boats, &c., are all the apparatus required for capturing the whale. When captured the animal is cut up, the blubber boiled and the oil extracted, and the whalebone dried.

Whalebone, or **Baleen**, a well-known elastic horny substance which hangs down in thin parallel plates from the sides of the upper jaw of the family of whales called Balænidæ (see *Whale*). These plates or laminæ vary in size from a few inches to 12 feet in length; the breadth of the largest at the thick end, where they are attached to the jaw, is about a foot, and the average thickness is from four- to five-tenths of an inch. On account of its flexibility, strength, elasticity, and lightness, whalebone was once employed for many purposes. Makers of umbrellas and corsets now use steel instead, but whalebone, though very scarce and dear, is still used in the brush industry. In commerce the plates of baleen are often called *whale-fins.*

Whale-louse (*Cyămus ceti*, order Amphipoda), a genus of small crustaceans, so named from living a parasitic life on whales and other cetaceans.

Whampoa, a port of China, on an island of the same name, 12 miles east of Canton, with commodious docks, &c., for the cleansing and repair of vessels.

Wharton, Thomas Wharton, Marquess of, born 1640, died 1715, is the reputed author of the celebrated political ballad *Lillibullero* (q.v.), and was severely castigated by Swift.—His son, Philip Wharton (1699–1731), was created a duke in 1718. Like his father, he lived a very profligate life, and is now chiefly remembered as the subject of Pope's satire, as his father was of Swift's.

Whately, Richard, British prelate and scholar, born in London in 1787, died in 1863. He received his education at a private school at Bristol, and at Oriel College, Oxford, graduated B.A. in 1808, and in 1810 won the English essay prize. In 1819 he made his first appearance as an author by publishing his famous *Historic Doubts relative to Napoleon Bonaparte.* In 1827 appeared his *Elements of Logic*, and in 1828 his *Elements of Rhetoric.* Both these works were written originally for the *Encyclopædia Metropolitana.* He occupied the chair of political economy at Oxford in 1830–1, and afterwards published *Introductory Lectures on Political Economy.* In 1831 he was appointed Archbishop of Dublin, a position in which he did much for national education and other worthy objects in Ireland, including the foundation and endowment of a chair of political economy in Trinity College.

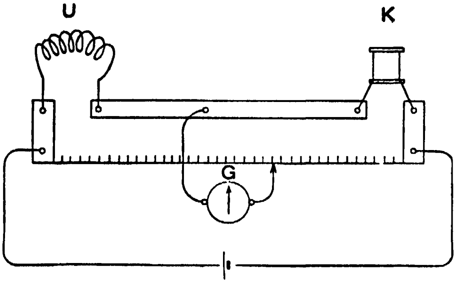
Wheat (*Triticum sativum*), the most important species of grain cultivated in Europe, and a great crop in North America, India, Argentina, Australia, &c. It grows readily in almost every climate; but its natural home seems to be a temperate climate, and the soils best adapted for its culture are rich clays and heavy loams. Of cultivated wheats there are many varieties, the differences, however, being partly due to soil, climate, and mode of cultivation. Three primary varieties may be mentioned: (*a*) *T. hybernum* (*muticum*), winter or unbearded wheat; (*b*) *T. æstivum* (*aristatum*), summer or bearded wheat; (*c*) *T. Spelta* (*adhærens*), spelt or German wheat, which is of much less value than the others, but grows on poorer soils and more elevated localities. White wheat and red wheat are names applied according to the colour of the grain; the red sorts are generally hardier than the white, but are of inferior quality, and the yield is less. Winter wheat is sown in the autumn, with the view of being harvested the following year; summer wheat is sown in the spring of the year in which it is reaped. The best English wheat yields from 75 to 85 per cent of fine flour, the inferior kinds only from 54 to 68 per cent. See *Flour.*

Wheat-ear (*Saxicŏla œnanthe*), a perching bird of the thrush family. Its average length is 6½ inches, and its colour grey above, breast brown, and under parts white. The wheat-ear, also known as the *fallow-chat*, is a summer visitant in Britain.

Wheat-fly, a name common to small flies of the genera Diplosis and Cecidomyia, applied especially in England to *Diplosis tritici*, sometimes also called the *wheat-midge.* It is a two-winged gnat about the tenth of an inch long, and appears about the end of June. The females lay their eggs in clusters among the chaffy flowers of the wheat, where they produce little footless maggots, whose ravages destroy the flowers of the plant, and render it shrivelled and worthless. The American wheat-fly (*Cecidomyia destructor*) is described under *Hessian-fly.*

Wheatstone, Sir Charles, British physicist and inventor, born at Gloucester in 1802, died at Paris in 1875. Before he was of age he commenced business for himself in London as a maker of musical instruments, and in 1823 attracted the attention of men of science by the publication in Thomson's *Annals of Philosophy* of a paper entitled *New Experiments on Sound.* This was followed by a number of other papers, some of them describing inventions of his own, all of which are remarkable for their ingenuity and delicacy of mechanical construction. In 1834 Wheatstone was appointed professor of experimental philosophy in King's College, London, but he seldom lectured. In 1836 he exhibited at King's College experiments showing the velocity of electricity, which suggested to him the idea of applying his apparatus to telegraphing, and in 1837, in conjunction with W. F. Cooke, he took out the first patent for the electric telegraph. He was a Fellow of the Royal Society from the year 1836, and in 1868 he received the honour of knighthood. He was the author of numerous papers, chiefly contributed to the *Philosophical Magazine* and the *Journal of the Royal Institution.*

Wheatstone's Bridge, an electrical instrument much used for measuring resistances. A simple form of the instrument is shown in the figure. It has heavy brass connectors to provide means for joining the known and unknown resistances in series, and for joining these resistances in parallel with a uniform wire of some definite length, say a metre. The current from the battery will be divided between the two arms of the circuit. The drop in pressure per unit length along the uniform wire will be constant. If the connection from the galvanometer is moved along the wire of the instrument, the current in the galvanometer will vary, and it will vanish altogether if the point of connection is suitably chosen. When this point is obtained, the drops in pressure through the resistances will be equal to those in the parts of the instrument wire on either side of the balance point. As the lengths of the wire are proportionate to the resistance, the ratio of the values of the two resistances can be readily obtained, and since one is known, the other can be easily calculated.



Wheatstone's Bridge

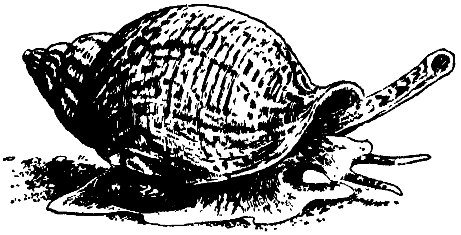
U, Unknown resistance. K, Known resistance. G, Galvanometer.

A simple method of measuring resistance is to connect the coil in question to a suitable source of supply and measure the pressure drop across the coil and the current passing. Ohm's law gives the means of determining the resistance, for $R = V/i$. Insulation resistances are measured by applying a known electrical pressure—in the case of house and factory wiring this is usually 500 volts, obtained from a small hand-rotated generator (see *Ohmmeter*)—to the circuit. The current passing gives an index to the value of the insulation, but the instrument is graduated in megohms to facilitate the work. The insulation from the system to earth is measured, as well as that from the one cable to the other, after all lamps and other connections between the two sides of the system are out of circuit. The determination of the position of faults in cable systems by the measurement of resistance is of considerable service to the electrical engineer.—Bibliography: H. R. Kempe, *Electrical Testing*; J. A. Fleming, *Handbook for the Laboratory and Testing Room*; F. C. Raphael, *Localization of Faults in Electric Light Mains*.

Wheel and Axle, a mechanical device consisting of a combination of a pulley, usually grooved, and a drum fixed to rotate together. It is merely a form of lever by means of which a small effort is used to raise a heavier load. The radii of pulley and drum are the arms of the lever, and the fulcrum is on the common axis of the pulley and drum. The system has many advantages over that of the simple lever, for the actions are not confined to a small lift, as the revolving system may be turned many times in the process of working. The winch, windlass, and capstan are applications of the wheel and axle.

Wheeling, a city and port of West Virginia, United States, the largest city in the state and the county seat of Ohio county, on Ohio River; served by the Baltimore, Ohio, and other railways. It is the most important place on the river between Pittsburg and Cincinnati. Coal is largely worked in the neighbourhood; there are iron-foundries and forges, nail-, glass-, and paper-works, cotton, silk, and steam-engine manufactories, and a brisk traffic by river and railroad. Settled in 1769, it was chartered as a city in 1836. Pop. (1920), 56,208.

Whelk, a general name applied to various species of sea-snails. The large or common whelk (*Buccinum undātum*) is found on the coast of Great Britain, and is distinguished by the shell having its canal notched, and the mouth or aperture of large size. The whelks are typically carnivorous. They are largely used for food and bait.



Dog-whelk, with Body exposed

Whewell (hū'el), William, English scholar and philosopher, born in 1794, died in 1866. From Haversham Grammar School he went to Trinity College, Cambridge, where he graduated B.A. in 1816, as second wrangler and second Smith's prizeman. In 1828 he was elected professor of mineralogy. In 1832 he resigned this chair for that of moral philosophy, which he held till 1855, when he became vice-chancellor of the university. In 1841 he was nominated to the mastership of Trinity, and in this position did much to secure for the natural and moral sciences a better recognized position among the studies of the university. He became Fellow of the Royal Society in 1820, and was one of the first members of the British Association, of which he was president in 1841. Among Whewell's multifarious writings may be mentioned the Bridgewater treatise, *Astronomy and General Physics, considered with reference to Natural Theology* (1833); *History of the Inductive Sciences* (1837); *Philosophy of the Inductive Sciences* (1840); *History of Scientific Ideas*; *On Liberal Education in General*; and *Lectures on Political Economy* (1863).

Whig. The term 'Whig' or 'Whiggamore' is Scottish in origin; it is believed to be derived from a word addressed to their horses by carters belonging to the south-west of Scotland when fetching supplies from Leith. The word was therefore applied to the drivers themselves, and when a body of Covenanters from the south-west marched upon Edinburgh in 1648, it was known as the Whiggamores' Raid. From that time 'Whig' was a contemptuous term for the extreme Presbyterians, and in the reign of Charles II it was used for the Covenanters who opposed the king. Hence it came to be employed in England, also originally as a term of ridicule for the Opposition which denied the divine right of kings and proposed to interfere with the natural order of the succession by excluding the Duke of York from the throne. The early Whig party was discredited by the credence which it gave to the Popish Plot and by the Rye House Conspiracy, but it was revived by the misgovernment of James II, and the leading spirits of the Revolution were a body of Whig noblemen and gentlemen. In the reigns of William III and Anne the Whig party were the supporters of the Revolution settlement and of war with France, and the opponents of a Stewart restoration. They were out of office in the last four years of Anne's reign, but the accession of George I gave them a permanent lease of power, for the House of Hanover could not employ the Tories, who were suspected of Jacobitism. One Whig ministry succeeded another until after the accession of George III, and the party naturally split into cliques and factions. Divisions among the Whigs continued even after the Tories, purged of Jacobite tendencies, became their rivals, and during the latter half of the reign of George III the party became unpopular because of its opposition to the French war. It regained credit and popularity in the struggle for parliamentary reform, and the Reform Act of 1832 was carried by a Whig ministry. Soon afterwards the name Whig came to be regarded as old-fashioned, and was abandoned in favour of the new term 'Liberal'.

Whin-chat, a small perching bird of the thrush family (*Pratincŏla rubetra*). It is common in the British Islands during summer, frequenting broom and furze, on the highest twigs of which it perches, and occasionally sings very sweetly. It is closely allied to the stone-chat (q.v.).

Whipping, a punishment inflicted by the law of England chiefly for minor offences. The Criminal Law Consolidation Acts (24 and 25 Vict. cap. xcvi–c, 1861) enumerate several offences for which the punishment may be inflicted on males under sixteen. A subsequent Act enacts that when the offender is under fourteen the number of strokes is not to exceed twelve. The Criminal Law Amendment Act, 1912, provides that any male person convicted of certain offences against morality may now be whipped in addition to any other punishment. Act 26 and 27 Vict. cap. xliv enacts that, in all cases of robbery or intent to rob, where the attempt is accompanied by personal violence, the court may, in addition to the other punishments provided by the laws, direct that the offender, if a male, be once, twice, or thrice privately whipped. This law was chiefly aimed at the practice of garrotting (see *Garrote*). By 1 Geo. IV cap. lvii it is enacted that no female shall be whipped.

Whip-poor-Will, the popular name of an American bird, the *Antrostŏmus vocifĕrus*, allied to the European goat-sucker or night-jar, and so called from its cry. It is very common in the eastern parts of the United States; is about 10 inches long, and feeds on flying moths and other insects. Its note is heard in the evening, or early in the morning. During the day these birds retire into the darkest woods.

Whirlwig, or **Whirlwig-beetle** (*Gyrīnus natātor*), a beetle which abounds in fresh water in Britain, and may be seen circling round on its surface with great rapidity. Its eyes are divided by a narrow band, so that, although it has only two, it looks as if it had four.

Whirlwinds are violent winds revolving round a vertical axis, being in this respect similar to, though much smaller than, tropical cyclones. On the smallest scale they may be seen in the dust-whirls which sometimes occur in hot weather. The axis has a progressive movement along the earth's surface. They are most common in desert regions, being produced by the intense heating of the ground, with resulting rapid convection. Sand, dust, and articles of all kinds may be lifted up into the air and scattered promiscuously. Storms of this kind occasionally happen even in Britain. On 27th Oct., 1913, a cyclone travelled along the west of England, accompanied by lightning and very heavy rain. It lasted at a given place 4½ minutes, and had a track only 150 yards wide. On its course it stripped trees of their branches or uprooted them. In one locality several cows were lifted over a high hedge into an adjoining field, and three were killed. Exactly three years later, on 27th Oct., 1916, and again on 27th July, 1918, whirlwinds passed through Essex. In the former case thousands of oaks and elms were seriously injured, and the village of Writtle suffered damage to the extent of over £3000.

Whisky. See *Wines and Spirits.*

Whist, long the leading card-game of the English-speaking race, developed from *trump* or *triumph*, popular in the sixteenth century. It was once also known as *whisk*, both names apparently referring to the need for silence during play. Whist is played by four players, two against two, with a full pack of cards. The partnerships are usually decided by ' cutting ', the two lowest playing the others. A second cut is made for ' deal ', the lowest dealing. In cutting the ace is the lowest card; in play it is the highest, being followed by king, queen, knave, ten, &c. When dealing to himself the fifty-second card, the dealer exposes it; and that suit is ' trumps ' for the hand. He puts the card in his own hand when the first trick is taken up. Sometimes—especially in the United States—the exposure of a card is avoided by drawing a card for trumps, and then reshuffling the pack. The player on the dealer's left leads, most often from his strongest suit, though a ' singleton ', if he has one, may often be led with advantage. Players must follow suit if able to do so; failing this, they may ' discard ' or trump the trick. A general rule is that the second player—the dealer's partner—should play low, the third hand playing high to take the trick. All tricks secured above six count; ' honours '—ace, king, queen, knave—are also counted towards the game, though not in favour of a partnership whose score is four. In short whist, now practically universal, five is ' game '. The ' rubber ' is two games out of three; if two successive games are won by the same side, the third is not played. Honours are ' easy ', nothing being scored, when two are held by either side; three honours on one side count ' two ', while four count ' four ' as points. Two points are also scored for the rubber, and others in a somewhat complicated manner for each ' game '. Cavendish's *Principles of Whist* (1902), is one of the soundest handbooks.

Whistler, James Abbott M'Neill, painter and etcher, born at Lowell, Massachusetts, in 1834, died in London 1903. He studied in Paris under Gleyre, identified himself with the Impressionists, and exhibited with Manet, Monet, and others at the 1863 Salon des Refusés. In 1863 he came to London, where he remained the rest of his life, save for occasional residences in Paris. Much influenced by Japanese art, Whistler laid great emphasis in his work on design, and on harmony of colour and tone. Characteristic of him are the series of ' nocturnes ' and ' symphonies ' in which one colour dominates the whole picture, much as the key does a piece of music. In his portraits the influence of Velasquez, with his fondness for silhouetting, is evident. Important examples are: *The White Girl* (1862); *Portrait of My Mother* (1872), now in the Luxembourg Gallery, Paris; *Portrait of Carlyle* (1872), purchased by Glasgow Corporation in 1891; *Miss Alexander* (1888), now in the Tate Gallery; and *Sarasate.* As an etcher and lithographer Whistler is in the first rank. The irony and power of invective which made him a conspicuous social figure are well reflected in his writings, notably *The Gentle Art of Making Enemies* (1890) and *The Baronet and the Butterfly* (1899).

Whitby, a seaport and watering-place of England, in the North Riding of Yorkshire, at the mouth of the Esk, which divides it into two nearly equal parts, and is spanned by a stone bridge with a movable centre-portion for admitting vessels into the inner harbour. The town is situated on bold acclivities, and has the ruins of an ancient Benedictine abbey (A.D. 657). Jet ornaments are made, jet being found there; and the fisheries are important. Pop. (1921), 12,512. Whitby was one of the towns shelled by German battle-cruisers on 16th Dec., 1914.

White, Gilbert, British naturalist, born in 1720 at Selborne, in Hampshire, died in 1793. He was educated at Oriel College, Oxford, of which he became a Fellow in 1744. He declined all Church preferment, but in his latter years served as curate in his native village. His *Natural History of Selborne* was published in 1789, and has retained a deserved and unimpaired popularity to the present day. He was also the author of letters on the antiquities of Selborne.—Cf. Rashleigh Holt-White (editor), *The Life and Letters of Gilbert White of Selborne.*

White, Henry Kirke, English poet, born in 1785, died in 1806. He was the son of a butcher, but through the exertions of several friends he was admitted a student of St John's College, Cambridge. There he applied himself to his studies with such unremitting labour that he became ill and died. His *Remains*, consisting of poems, letters, &c., were edited by Southey. His reputation, which was due in part to his early death, has not lasted; and his poems, which are innocuous but mawkish, are largely forgotten.

White-bait, a name for the young of the herring and sprat, long regarded as a distinct fish, or as the fry of the shad. It abounds in the Thames during spring and summer, and is much prized by the Londoners. It has a length of 2 to 5 inches, and is pale silvery in colour with a greenish hue on the back. It is not peculiar to the Thames, but occurs in the Clyde, Forth, and elsewhere.

Whiteboys, an illegal association formed in Ireland about 1760; so named because its members disguised themselves by wearing their shirts over their clothes. The association consisted of starving day-labourers, evicted farmers, and others in a like condition, who used to assemble at nights to destroy the property of harsh landlords or their agents, the Protestant clergy, the tithe collectors, or any others that had made themselves obnoxious in the locality. In many cases they did not confine their acts of aggression merely to plunder and destruction. but even went the length of murder.

Whitefield, George, English evangelist and founder of the Calvinistic Methodists, was born in 1714 at Gloucester, died at Newburyport, Mass., in 1770. At the age of eighteen he entered as servitor at Pembroke College, Oxford, where he became acquainted with the Wesleys, and joined the small society which procured them the name of Methodists. He was ordained deacon in 1736, and soon became very popular as a preacher. In 1738 he went to the American settlement of Georgia, where his ministrations gave great satisfaction to the colonists. In the following year he returned to England to procure subscriptions for building an orphan-house in the settlement. Having taken priest's orders, he repaired to London, where the churches in which he preached proved incapable of holding the crowds who assembled to hear him. He now adopted preaching in the open air, and visited various parts of the country, addressing vast audiences. In 1739 he again embarked for America, and made a tour through several of the provinces, preaching with great effect to immense crowds. He returned to England in the following year, where for a time differences between him and Wesley deprived him of many followers. After visiting many parts of England, Scotland, and Wales he again returned to America, and remained there nearly four years. Soon after his return he was introduced to the Countess of Huntingdon, who made him one of her chaplains. A visit to Ireland and two more voyages to America followed, and for several years his labours were unremitting.—Cf. Luke Tyerman, *Life of George Whitefield.*

Whitehall, a locality in Westminster, where are the Admiralty Office, the Horse Guards, and other important Government offices. On the bank of the Thames was a palace called Whitehall, built before the middle of the thirteenth century. In 1530 it became the residence of the court, but in 1697 was destroyed by fire, excepting the Banqueting House, added by James I, from a design of Inigo Jones, in 1619. Charles I was executed in front of Whitehall, and Cromwell died there. The Banqueting House is now the United Service Museum.

Whitehaven, a municipal borough and seaport of Cumberland, England, on a bay of the Irish Sea, has a custom-house, market-house, good harbour and dock, and enjoys a considerable shipping trade. The principal exports are coal, pig-iron, rails, and iron ore. Shipbuilding is carried on, and there are blast-furnaces and iron- and brass-foundries. The coal- and iron-mines in the neighbourhood raised Whitehaven to importance as a seaport. Pop. (1921), 19,536.

White Mountains, a range in the north-east of the United States, in New Hampshire, belonging to the Alleghanies. They have fine scenery, and are a favourite summer-resort. The culminating point is Mount Washington (6288 feet).

White River, (1) a river of Arkansas, United States, with a course of 800 miles. It joins the Mississippi above the influx of the Arkansas River, and has several important affluents. Together with its tributaries it affords 500 miles of boat navigation. (2) A river in Indiana, formed by the confluence of the East and West Forks, emptying into the Wabash near Mount Carmel.

White Sea, a large gulf of the Arctic Ocean, penetrating into Northern Russia to the distance of between 300 and 400 miles. It has an area of about 47,000 sq. miles, with a coast-line of 1000 miles. It is navigable only from the middle of May to the end of September, being frozen over the rest of the year. About thirty rivers, among which the principal are the Northern Dwina, the Onega, and the Mezene, empty themselves into the White Sea. At the mouth of the Dwina lies Archangel, the commercial emporium of this region. Two canals, uniting the Dwina with the Volga and the Dnieper, connect the White Sea with the Caspian and Black Seas. See *Murman.*

White-swelling, the popular name for all severe diseases of the joints resulting from chronic inflammation in the bones, cartilages, or membranes constituting the joint. Among the diseases known under this name are: (*a*) acute or chronic inflammation of the synovial membrane; (*b*) pulpy thickening of the synovial membrane; (*c*) ulceration of the cartilages; (*d*) tubercular diseases of the joints beginning in the bones. They may arise as effects of phlebitis, gout, rheumatism, syphilis, tuberculosis, or mercury. The knee, ankle, wrist, and elbow are the joints most subject to white-swellings.

White-throat, a small singing bird of the warbler division of the thrush family. The common white-throat (*Sylvia cinerea*) attains a length of 5 inches, frequents gardens and hedges, and is a regular summer visitor to the British Islands. The lesser white-throat (*S. curruca*) is also a summer visitor to Britain.

Whitgift, John, English prelate, born 1530, died 29th Feb., 1604. Educated at Cambridge, he imbibed from his uncle, Abbot Whitgift, opinions that inclined him later to the side of the Reformation. By a cautious reserve, however, he escaped persecution during the reign of Queen Mary, and on the accession of Elizabeth was ordained priest. He held successively many posts at Cambridge, including the mastership of Pembroke Hall and Trinity College, and the regius professorship of divinity. In 1577 he was appointed Bishop of Worcester, and on the death of Grindal (1583) was raised to the primacy. He had always been a rigid disciplinarian; but he now became an inquisitor, insisted on new articles of subscription, suspended the clergy who refused them, and in every way acted as the intolerant ecclesiastic. He took a leading part in the conference at Hampton Court under James I. —Cf. W. F. Hook, *Lives of the Archbishops of Canterbury*.

Whithorn, a town of Wigtownshire, Scotland, a royal burgh whose present charter dates from 1511 (James V), but was originally granted by Robert I (the Bruce). It is especially connected with St. Ninian. Pop. (1921), 1299 (burgh), 1989 (parish).

St. Ninian, or Ringan, the first apostle of Scotland, died in A.D. 432. His day is 16th Sept. In 397 he founded the *Candida Casa* (or White House), which probably stood on the present Isle of Whithorn. "They say that before that none in Britannia had been constructed of stone. And having first learned that the most holy Martin . . . had passed from earth to heaven, he was careful to dedicate the church itself in his honour" (cf. the *Life* of St. Ailred (Abbot of Rievaulx) in vol. v of *The Historians of Scotland*). A bishopric of Whithorn founded by the Angles in 727 came to an end in 796, and in the reign of David I (1124–53) the see of Galloway was established, and a Premonstratensian priory was founded at Whithorn and ultimately became a cathedral. Whithorn was for long a pilgrimage centre, and the ruins of the cathedral can still be seen.

Whiting (*Gadus merlangus*), a well-known fish belonging to the cod family. It abounds on all the British coasts, and in the seas of Northern Europe generally, and exceeds all the other fishes of its kind in its delicacy and lightness as an article of food. It does not usually exceed 1½ lb. in weight.

Whitley Bay, a seaside-resort of Northumberland, England, about 2 miles north-east of Tynemouth. Whitley sands are popular. The town forms part of the urban district of Whitley and Monkseaton, which has a pop. (1921) of 22,255.

Whitlow, an inflammation of the tissues of the finger liable to extension within the member and into the hand and forearm. A whitlow may be no more than a gathering beneath the cuticle, when fomentation usually suffices for its cure, or it may extend more deeply in the tissues. When the sheath covering a tendon is infected, spread into the hand and wrist is facilitated in the case of the thumb and little finger, the sheaths of which communicate directly with that in the palm. Thus the seat of origin of the trouble in reference to the anatomy of the hand largely determines the extent of spread. For this reason infection of the nail-bed, even if it should involve the bone, does not imply extension so certainly as infection of the tendon sheaths. In all cases local swelling, pain, and tenderness are present, with formation of pus as the disorder progresses. Constitutional symptoms show themselves, and are severe in proportion to the extent of the inflammatory process. Surgical treatment is called for in all but the least severe forms of whitlow.

Whitman, Walt, American poet, born in Long Island, in the state of New York, in 1819, died in 1892. In his early days he worked at carpentry and printing. Subsequently he became a school teacher, and wrote for the press. During the Civil War Whitman devoted himself to the care of the wounded in the hospitals of Virginia and Washington, and at the end of the war came out with his constitution irretrievably broken. He subsequently entered the Government service in the capital, remaining there till 1874. He then removed to Camden, N.J. In 1887 his English admirers raised a subscription in his behalf. His poems are like nothing else in the language, rough, rude, chaotic even, but strongly individual. The best known are: *Leaves of Grass* and *Drum Taps*. *Democratic Vistas*, *Specimen Days and Collect* and *November Boughs* contain his prose writings, old and new, though it is difficult in the case of Whitman to distinguish prose from poetry in the ordinary senses of the terms.

Whitstable, a seaport of Kent, England. It has extensive oyster-fisheries, and there is a small coasting trade. Pop. (1921), 9800.

Whittier, John Greenleaf, American poet, born of Quaker parents in 1807 at Haverhill, Mass., died in 1892. Educated at the academy of his native place, he worked on his father's farm and learned the shoemaking trade, but early began to write for the press. In 1831 he published his first work, *Legends of New England* in prose and verse. Among the numerous volumes of poetry which he from time to time gave to the world the following may be mentioned: *Moll Pitcher*, *Lays of my Home*, *Miscellaneous Poems*, *The Voices of Freedom*, *Mabel Martin*, *Hazel Blossoms*, *The King's Missive*, *Poems of Nature*, *St. Gregory's Guest*, &c. Whittier's poems are distinguished by their freshness, their quiet power, and intense feeling. —Cf. S. T. Pickard, *Life and Letters of John Greenleaf Whittier*.

Whittlesey, a town of Cambridgeshire, England. Pop. (1921), 4200.

Whitwood, an urban district and mining centre of Yorkshire (West Riding), England, on the Calder. Pop. 5940.

Whitworth, Sir Joseph, English engineer, was born in 1803, and died in 1887. After working as a journeyman in Manchester and London, he started business in the former city in 1833 as a manufacturer of engineers' tools, thus founding the great firm of which he was long the head. He was known for a system of screw-threads, and also for his standard gauges. In 1854–5 he began his experiments with fire-arms, which led to the production of the Whitworth gun, and later brought him into competition with Armstrong as a manufacturer of rifled ordnance. He was also the originator of the fluid-pressed steel, used in the manufacture of cannon and ships' plates. His baronetcy was conferred in 1869. He is the author of *Guns and Steel* (1873).

Whitworth, a town of Lancashire, England, with cotton-factories, coal-mines, and quarries. Pop. (1921), 8782.

Whitworth Scholarships, scholarships established in 1869 by Sir Joseph Whitworth, to encourage the cultivation of combined theoretical and practical skill in mechanics and engineering. There are (1923) six scholarships of an annual value of £125, tenable for three years; and two senior scholarships of an annual value of £250, tenable for two years. Candidates for the scholarships must be under twenty-one years of age, and candidates for the senior scholarships under twenty-six, on the 1st of May in the year in which they compete.

Whooping-cough, or **Hooping-cough**, is a disease characterized by catarrh of the respiratory passages and a series of convulsive coughs which end in a long-drawn inspiration or 'whoop'. It is probably due to a specific germ, the bacillus pertussis, and occurs in epidemic form, most frequently in winter or spring, among children of school age. It is also seen in earlier life, and is often fatal among infants, while in adults, though rare, it may run a long and distressing course. It is directly contagious from person to person, but rooms may be infected by a patient, though it is less contagious in this way than the other infectious diseases. The disease is most contagious during the catarrhal period, when it is not easily recognized, and there is less danger of infection in the later weeks. The onset is similar to an ordinary cold, with a persistent cough; after about a week, instead of subsiding, the cough becomes worse and convulsive in character. These attacks of coughing in the course of a few days become paroxysmal, and the 'whoop' appears. Vomiting often takes place at the end of a paroxysm, and may recur with great frequency.

The high mortality in children is largely due to the complications that arise; the chief of these are anæmia and emaciation, due to the frequent vomiting, acute bronchitis, pleurisy, and broncho-pneumonia, these latter chest complications causing the great bulk of the deaths. Heart disease, chronic bronchitis, and asthma are the most serious sequels, and even tuberculosis may affect the child weak and debilitated as a result of whooping-cough.

The gravity of this disease is not yet appreciated by the public. The child should not be sent to school nor exposed in public in any way. Complete isolation, and if the paroxysms are at all severe, rest in bed, should be carried out in every case. The cough may persist for many months, and during convalescence the child should be watched with great care, as it is at this time that broncho-pneumonia, the most fatal of all the complications, is liable to set in.

Whortleberry (Vaccinium), a genus of shrubby plants, the type of the nat. ord. Vacciniaceæ, with alternate leaves, pink or red bell-like flowers, and berries of a dark-purple, bluish, or red colour. The common whortleberry, bilberry, or blaeberry (*V. myrtillus*) is a hardy plant, which grows in forests, heaths, and on elevated mountains. In some of the pine forests of Scotland the plant attains the height of 3 feet. The berries have a pleasant, sweet taste, and are used for making jelly. The berries of the red whortleberry (*V. Vitis-idæa*) are of a bright-red colour, and possess acid and astringent properties; from their similarity to cranberries they are sold as such in various parts of Scotland (see *Cranberry*). Whortleberries in North America are generally known as huckleberries.

Why'dah, a town of West Africa, in the French colony of Dahomey, on the Bight of Benin. Pop. about 12,000.

Whydah-bird, or **Widow-bird**, a name given to weaver-birds of the genus Vidua, inhabiting Western Africa, and found in abundance in the kingdom of Dahomey, near Whydah. In size the whydah-bird resembles a linnet or canary, and during the breeding-season the male possesses long, drooping tail-feathers, giving it a graceful appearance.

Whyte-Melville, George John, British novelist, born in 1821, died in 1878. He entered the army, fought in the Crimean War, and first became known as a novelist in 1853, when he published *Digby Grand*. This was followed by *General Bounce*, *Kate Coventry*, *Market Harborough*, *The Gladiators*, *Sarchedon*, *Satanella*, *Holmby House*, and *Bones and I*.

Wich'ita, a city of Kansas, United States, the county seat of Sedgwick county, on Arkansas River. It is the most important railway centre in the state, and carries on slaughtering and meat-packing. Settled in 1870, it became a city in 1871. Pop. (1920), 72,128.

Wick, a royal burgh and seaport of Scotland, capital of the county of Caithness, at the head of the Bay of Wick, and on the River Wick, over which is a bridge connecting it with its suburb Pulteney-Town. The staple employment is herring-fishing. Pop. (1921), 10,615.

Wicklow, a maritime county of Ireland, in the province of Leinster; area, 499,957 acres. The coast is mostly precipitous, and dangerous from sand-banks. The surface is diversified and picturesque, rising into the Wicklow Mountains, the loftiest of which is Lugnaquilla (3039 feet altitude). Its minerals include a little gold in the streams, lead and copper ores, and pyrites in considerable quantities. The principal rivers are the Slaney, Vartrey, and Avoca. Bray, Arklow, Wicklow, and Baltinglass are the chief towns. Pop. 60,711.

Wicklow, the county town of Wicklow, Ireland, a prominent seaside-resort, with chemical-works and exports of cereals. Pop. 3000.

Widdin, or **Vidin**, a town of Bulgaria, on the right bank of the Danube. There is a considerable trade, chiefly in corn, wine, and salt. Pop. (1920), 17,722.

Widgeon, or **Wigeon**, a species of aquatic bird belonging to the Anatidæ or duck family; the *Marĕca penelŏpe.* It breeds occasionally in the most northern parts of Scotland, but the ordinary breeding-place is in more northern regions. They are numerous in the British Islands during the winter, and are in request for the table. The American widgeon is the *M. americāna.* It is most abundant in Carolina.

Widnes, a municipal borough of Lancashire, England, on the Mersey (here crossed by a 'transporter' bridge to Runcorn and a railway bridge). There are extensive chemical-works; copper-smelting works, rolling-mills, iron-foundries, &c. Pop. (1921), 38,879.

Wiedemann, Gustav Heinrich, German physicist, born 1826, died 1899. He studied at Berlin, held various professorships, and in 1887 was appointed to the chair of physics at Leipzig. He was editor of one series of Poggendorff's *Annalen der Physik und Chemie,* and wrote a well-known comprehensive textbook of electricity and magnetism.

Wieland, Christoph Martin, German epic poet, born in 1733, died in 1813. He was educated at the University of Tübingen, and was appointed professor of philosophy in 1769 at Erfurt. The early period of his literary life was devoted to pietistic or at least serious poetry, such as *The Nature of Things* (1752), *Twelve Moral Letters in Verse, Anti-Ovid* (1752), and *The Trial of Abraham's Faith* (1753); in the second period he produced the romances *Agathon* (1766) and *Don Sylvio de Rosalva* (1764), the poem *Musarion* (1768), and a prose translation of Shakespeare in eight vols. (1762–6); while in the third and ripest period were written the romantic epic of *Oberon* (1781), *History of the Abderites* (1781; *The Republic of Fools*, London, 1861), *The Secret History of Peregrinus Proteus* (1791), &c.

Wieliczka (vyel-ich'kȧ), a town of Poland, Galicia, situated 8 miles south-east of Cracow, and noted for its extensive salt-mines. Pop. 10,000.

Wiener-Neustadt, a town of Austria, 25 miles south of Vienna. It was almost entirely destroyed by fire in 1834, but a number of interesting mediæval buildings yet remain. There are important manufactures of locomotives, machinery, pottery, leather, &c. Pop. (1920), 35,362.

Wiesbaden, a town of Prussia, in the province of Hesse-Nassau, finely situated at the foot of Mount Taunus, in the valley of the Salzbach, about 2 miles from the Rhine. It is noted for its hot medicinal saline springs, the temperature of the Kochbrunnen being 156° F. Wiesbaden is the *Mattiacum* of the Romans, and its waters (*aquæ Mattiacæ*) were known to Pliny (*Hist. Nat.*, xxi, 2). Pop. (1919), 97,566.

Wig (abbreviation of *periwig*, from *peruke*; Fr. *perruque*), an artificial head of hair. They have long been employed by savage races, both as ornaments and as emblems of dignity. They occur upon Egyptian mummies of an early date, and were in use among the Assyrians and Persians. They were employed in ancient Greece, being largely worn by actors, a red wig being the recognized head-dress of the rascally slave in comedy. It is believed that wigs were introduced to Italy from Crete; the Roman emperors used them, and they were much employed—by both sexes—as a means of disguise. The early Church inveighed with vigour but entirely without success against their use. In England Queen Elizabeth owned many different artificial heads of hair, which were practically wigs; while the taste was shared by her rival and victim, Mary of Scotland. But France was the true home, and the reign of 'le Roi Soleil' the best period, of the modern wig. Louis XIV owned a fine head of hair, and the French courtiers were driven to the use of wigs in flattering emulation of their monarch. After about 1670 Louis himself was compelled to accept the wig-maker's attentions, and the custom flourished till the Revolution. In Britain the use of wigs became general at, or shortly after, the Restoration, Pepys duly noting its adoption by himself. It flourished through the days of Anne, only declining in the reign of George III. The full-dress wig of this period still survives upon the heads of His Majesty's judges, while the barrister continues to plead in a tie-wig. The bag-wig took its name from the silken bag in which the flowing hair was stowed. Doctors had their own special style of wig, and many other classes of society could be distinguished by their head-gear. The present-day wigs of judges and barristers are of white horse-hair, curled and woven upon silk; jute is largely employed by theatrical wig-makers; while the wigs worn by persons prematurely or naturally bald are of human hair.

Wig'an, a town of Lancashire, England, on the Douglas. It stands in the centre of an extensive coal-field, and its manufactures consist chiefly of calicoes, fustians, checks, and other cotton goods, cotton twist, and linens. There are iron-foundries, iron-forges, railway-wagon works, iron-rolling mills, large breweries, chemical-works, and corn- and paper-mills. Pop. (1921), 89,447.

Wight, Isle of, an island off the south coast of England, in the county of Hants, separated from the mainland by Spithead and the Solent; 23 miles in length, 13 miles broad; area, 94,146 acres. The main slope of the island is to the north, as is shown by the course of its chief streams, the Medina, Yar, and Eastern Yar. A range of chalk downs, which cross the island from east to west and form excellent sheep-walks, separate it into two districts somewhat different in character. The general appearance is picturesque, and the geology of the island is interesting. The air is mild, and the district known as the Undercliff, lying along the south coast, and completely sheltered from the north, has long been a resort for invalids. The chief towns are Newport (the capital), Ryde, Cowes, Ventnor, Bembridge, Freshwater, Yarmouth, and the fashionable health-resorts of Sandown and Shanklin. Near Cowes is Osborne House (q.v.), once a residence of Queen Victoria. Carisbrooke Castle is an interesting ruin. Pop. (1921), 94,697.

Wigton, a town of Cumberland, England. Tanning and brewing are among its industries. Pop. (1921), 3659.

Wigtown, a royal burgh and seaport of Scotland, the county town of Wigtownshire, on the west side of Wigtown Bay. Pop. (1921), 1299.

Wigtownshire, a county of Scotland, occupying the south-western extremity of the kingdom, and forming the western division of Galloway; area, 314,405 acres. The coast is indented by deep and spacious bays, of which Wigtown Bay, Luce Bay, and Loch Ryan are the most important. The chief river is the Cree, which is partially navigable. Except in the peninsular portions (Rhinns of Galloway), the surface is better adapted for pasture than tillage, and a good deal of it is of poor quality. Pop. (1921), 31,000. Stranraer is the largest town; others are Wigtown (county town), Port-Patrick, and Newton Stewart.

Wilberforce, Samuel, English prelate, son of William Wilberforce, the philanthropist, born in 1805, died in 1873. He graduated at Oriel College, Oxford; was appointed curate of Checkendon (1828), rector of Brightstone in the Isle of Wight (1830); became a rural dean (1836), Canon of Winchester (1840), Bampton lecturer (1841), Dean of Westminster (1845), and in the same year Bishop of Oxford. He was the leader of the High Church party, and the author of numerous works. In 1869 he was translated to the see of Winchester.

Wilberforce, William, English statesman and philanthropist, born 1759, died 1833. After completing his education at St. John's College, Cambridge, he was, in 1780, elected member of Parliament for his native town; and in 1784 he was returned by the county of York. In 1786 he made the acquaintance of Clarkson, who gained his sympathies on behalf of the agitation against the slave-trade. In 1791 he moved for leave to bring in a Bill to prevent further importation of African negroes into the British colonies. Year after year he pressed this measure, but was always defeated till 1807, when it was passed during the short administration of Fox. He then devoted his energies to bringing about the total abolition of slavery, and three days before his death he was informed that the House of Commons had passed a Bill which extinguished slavery in the British colonies.—Cf. R. I. and Samuel Wilberforce, *Life of William Wilberforce.*

Wildbad, (1) a town of Württemberg, on the Enz; served by rail to Pforzheim. It is noted for its warm alkaline springs (93°–97° F.). Pop. 3000. (2) A town of Salzburg, Austria, also called Bad-Gastein (see *Gastein*). (3) Wildbad-Kreuth, a town of Bavaria, near the Tegernsee, on the Weissach, and among the Bavarian Alps at an altitude of about 2624 feet. The mineral springs have been known since the fourteenth century, and are visited by about a thousand persons annually. Pop. 200 to 300. (4) Wildbad-Trarbach or Bad Wildstein; mineral springs (95° F.) are located near Traben-Trarbach, a town of Rhineland, Prussia, on the Moselle; a junction on the railway from Pünderich for the Trier-Bullay line. The town comprises Traben, on the left bank of the Moselle, and Trarbach, on the right bank. Pop. 9000.

Wild Birds' Protection. By a British Act of Parliament passed in 1880 all wild birds are protected between 1st March and 1st Aug., certain of them mentioned in a schedule being prohibited to be killed or taken under a penalty of not more than £1 per bird, the others under a penalty of a reprimand and costs in the first instance, but for every subsequent offence *5s.* for each bird and costs in addition. This Act was amended by 44 and 45 Vict. cap. li, which excepted birds received from abroad, &c. By subsequent Acts county councils may protect any wild birds and their eggs.

Wilde, Oscar Fingal O'Flahertie Wills, Irish writer and æsthete, was born in Dublin in 1854, and died in Paris in 1900. His father was a celebrated surgeon, and his mother an erratic literary woman who had a literary *salon* and wrote under the name of 'Speranza'. Wilde was educated at Portora Royal School, Trinity College, Dublin, where he won the Berkeley gold medal, and Magdalen College, Oxford, where he took a first class both in Moderations and Literæ Humaniores, and won the Newdigate prize. He soon became a leader in the æsthetic movement, and was caricatured by *Punch*, and ridiculed by Gilbert as Archibald Grosvenor in *Patience*. He lectured in America on the æsthetic movement, but was engaged to do so in order to make *Patience* intelligible rather than to propagate his own gospel of art. His first volume of poems appeared in 1881. He wrote for several magazines and reviews, and for two years edited *The Woman's World*. In 1887 he published *Lord Arthur Savile's Crime* and *The Canterville Ghost*. In 1888 he published *The Happy Prince and other Tales*. His other works include: *The Portrait of Mr. W. H.* (see *Shakespeare*), *The Picture of Dorian Gray* (1890), and his plays *Salomé*, *Lady Windermere's Fan*, *A Woman of no Importance*, *An Ideal Husband*, and *The Importance of Being Earnest*. In 1895 Wilde, with fatal insolence, brought an action for criminal libel against the eighth Marquess of Queensberry. He lost his case, and was himself charged with offences under the Criminal Law Amendment Act, and sentenced to two years' imprisonment with hard labour. After his release he lived in France, broken in health and reputation. Part of his *apologia* was published in 1905 under the title of *De Profundis*. The rest is not to be published until 1960. The tragedy of Wilde's life was a matter for the pathologist rather than for the judge, and should arouse pity rather than disgust. His writings are all superficially clever, overladen with paradox and epigram, and of little permanent merit. His conversation was more striking than any of his poems, essays, or plays.

Wilhelmshaven, a detached town and port of the Prussian province of Hanover, an enclave of Oldenburg, on Jade Bay; served by rail to Oldenburg. It is the former imperial warharbour, and is named after Kaiser Wilhelm I, during whose reign the Prussian navy was founded (1849) and the Wilhelmshaven territory (4 sq. miles) acquired by purchase from Oldenburg (1859). After the European War the port was demilitarized. Pop. 30,000.

Wilkes, John, British politician, born 1727, died 1797. He was the son of a rich distiller, and was educated for some time at Leyden. Returned to Parliament as member for Aylesbury (1757), he attained considerable notoriety by the publication of a paper entitled *The North Briton*, in No. 45 of which (1763) he commented severely on the king's speech to Parliament. The Home Secretary in consequence issued a general warrant, upon which Wilkes, with others, was apprehended and committed to the Tower, but released by Chief Justice Pratt, who declared the prosecution illegal. On the next meeting of Parliament, however, a special law was passed to sanction his prosecution, and in 1764 he was expelled from the House of Commons. As he had by this time withdrawn to France and did not appear to receive sentence, he was outlawed. He returned, however, to England at the election of 1768, and was sent to Parliament as representative of Middlesex, but was expelled from the House and committed to prison. Three times after this he was re-elected within a few months by the same constituency, but the House of Commons persisted in keeping him out, giving rise to a formidable agitation in favour of 'Wilkes and liberty'. He was released from prison in 1770, having been elected alderman of London, and he was next appointed sheriff of Middlesex, Lord Mayor of London, and again (1774) member of Parliament for Middlesex. On this occasion he was allowed to take his seat, and in 1782 the resolutions respecting the disputed Middlesex election were expunged from the journals of the House of Commons. He published many speeches and pamphlets, and two collections of his correspondence were published after his death.—Cf. P. H. Fitzgerald, *The Life and Times of John Wilkes*.

Wilkesbarre, a city of Pennsylvania, United States, the county seat of Luzerne county, on the north branch of the Susquehanna; served by the Lehigh Valley, Pennsylvania, and other railways. It is the centre of a rich anthracite coal-field, and has manufactures of machinery, locomotives, cars, mining engines and tools, iron castings, ropes, brewery products, cutlery, lace, &c. Settled in 1769, it became a city in 1871. Pop. (1920), 73,833.

Wilkie, Sir David, Scottish painter, born 1785, died 1841. He received his early art training at the Trustees' Academy, Edinburgh; entered the schools of the Royal Academy, London, in 1805; first exhibited there (1806) *The Village Politicians*, which at once established his reputation; was elected an associate of the Academy in 1809, and in 1811 became an Academician. In 1825, owing to ill-health, he made an extended tour through Italy, Germany, and Spain. In the latter country his style as a painter underwent a marked change when he came under the influence of Velasquez and Murillo. Returning after three years to England, he was appointed (1830) painter in ordinary to the king, and was knighted in 1836. His pictures, such as the *Blind Fiddler, Rent Day, Cut Finger, Rabbit on the Wall, Penny Wedding, Cottar's Saturday Night*, &c., are well known as engravings. These belong for the most part to his early and best period, when his method was characterized by subdued colouring and minute and spirited drawing. His later and less successful style is distinguishable by a breadth of treatment which sometimes shows looseness in drawing, and deals chiefly with historical subjects. It is represented by *The Entrance of George IV into Holyrood, The Spanish Council of War, The Maid of Saragossa, Napoleon and Pius VII*, and *The Queen's First Council.*—Cf. Allan Cunningham, *The Life of Sir David Wilkie.*

Will, in philosophy and psychology, is the function by which man is able to give movement to his limbs and direction to his thoughts, and also to increase or diminish the intensity of his feelings. It is the sovereign and controlling faculty in man, distinct from instinct and impulse, implying choice between alternatives and knowledge of means needed to attain an end. Will constitutes human personality and the human ego, without will there being no ego, but a succession of phenomena. The will is usually described as one of the three faculties by means of which the human mind finds expression, the other two being *thought* (or intellect) and *feeling* (or emotion). The faculty of the will, in the maturity of its complex power, is conceived as having been educated by a process of sensation, pleasure and pain giving rise to the motives by which the active determining energy is set in motion. The exact relation, however, between will and motive, the question whether the motive governs the will, or the will determines the motive, has not been authoritatively settled. Some psychologists consider the will simply as a mechanical or biological equation, whilst for certain metaphysicians, like Schopenhauer and Hartmann, the will is a blind, unconscious driving force, common to all nature, animate and inanimate. See *Free-will.*

Will, or Testament, in law, the legal declaration of a man's intentions as to what he wills to be performed after his death in relation to his property. In England, as also in the British colonies and the United States, no will, whether of real or personal estate (except the will of a soldier or sailor on active service), is to be valid unless it be in writing, and signed at the foot or end by the testator, or by some person in his presence, and by his direction. Such signature must be made and the document acknowledged as his will by the testator in the presence of two or more witnesses present at the same time, and such witnesses must attest and subscribe the will in the presence of the testator. Any alteration or obliteration must also be duly signed by the testator and the witnesses. A will may be revoked by cancelling or obliteration, tearing, or burning; or by a new will expressly revoking the former, or containing provisions inconsistent with it; or by the subsequent marriage of the testator. In Scotland formerly only personal property could be disposed of by will, real property being conveyed by a disposition or deed in which the testator's life-rent in the subject was reserved, but heritable property can now be so disposed of. If a will is wholly, or in its essential parts, in the handwriting of the testator, the law of Scotland does not require the signature of the testator to be witnessed, but unless a will contains a declaration that the handwriting is the testator's, the handwriting must be proved after the testator's death by two persons acquainted with it.

Willemstad, a town of the Netherlands West Indies, capital of the colony of Curaçao. It is a port, and has considerable trade. Pop. about 13,000. — There is a Willemstad in North-Brabant, Netherlands. Pop. 3000.

Willenhall, a town of England, in West Staffordshire. There are brass- and iron-foundries, but the staple industry is in locks and padlocks. Pop. (1921), 19,671.

Willesden, a parish and urban district in Middlesex, a suburb of London, 7 miles north-west of St. Paul's. It is an important railway junction, and has an old church. Pop. (1921), 165,669.

Willet (*Symphemia semipalmata*), a bird of the plover family found in temperate America, and migrating as far south as Brazil, also to Europe. It is a fine game-bird, and its flesh and eggs are prized for food. Called also *stone curlew.*

William I, surnamed *the Conqueror*, King of England and Duke of Normandy, born 1027, died at Rouen 9th Sept., 1087. He was the natural son of Robert, Duke of Normandy, by Arlotta, the daughter of a tanner of Falaise. His father having no legitimate son, William became the heir at his death, and ruled Normandy with great vigour and ability. The opportunity of gaining a wider dominion presented itself on the death of his second cousin, Edward the Confessor, King of England, whose crown he claimed. To enforce this claim he invaded England, and the victory of Hastings, in which his rival, Harold, was killed, ensured his success (1066). He then established the administration of law and justice on a firm basis throughout England, conferred numerous grants of land on his own followers, and introduced the feudal constititution of Normandy in regard to tenure and services. He also expelled numbers of the English Church dignitaries and replaced them by Normans. Towards the end of his reign he instituted that general survey of the landed property of the kingdom, the record of which still exists under the title of *Domesday Book*. In 1087 he went to war with France, whose king had encouraged a rebellion of Norman nobles. He entered the French territory, and committed great ravages, but when he burnt Mantes, his horse trod on a hot cinder and stumbled, and he was thrown forward in his saddle and received an internal injury which caused his death at the abbey of St. Gervais, near Rouen.—BIBLIOGRAPHY: E. A. Freeman, *William the Conqueror*; *History of the Norman Conquest*; Sir P. Vinogradoff, *English Society in the Eleventh Century*.

William II, surnamed *Rufus*, from his ruddy complexion, third son of the preceding, was born in Normandy in 1056, died in 1100. Nominated by his father to the English succession in preference to his elder brother Robert, he was crowned at Westminster in 1087. The Norman barons, however, were discontented, and sought to make Robert King of England, but this project was defeated by William, who secured the aid of Lanfranc, Archbishop of Canterbury, and the English nobles. A characteristic incident in William's reign was his contention with Anselm, Archbishop of Canterbury, regarding Church property and the sovereignty of the Pope. He met his death while hunting in the New Forest, by an arrow shot accidentally or otherwise from the bow of a French gentleman named Walter Tyrrel.—Cf. E. A. Freeman, *William Rufus*.

William III, Stadtholder of Holland and King of England, son of William II of Nassau, Prince of Orange, and Henrietta Mary Stewart, daughter of Charles I of England, was born at The Hague on the 4th of Nov., 1650, died 8th March, 1702. During his early life all power was in the hands of the grand pensionary John De Witt, but when France and England in 1672 declared war against the Netherlands, there was a popular revolt, in which Cornelius and John De Witt were murdered, while William was declared captain-general, grand-admiral, and stadtholder of the United Provinces. In the campaign which followed he opened the sluices in the dykes and inundated the country round Amsterdam, thus causing the French to retire, while peace was soon made with England. In subsequent campaigns he lost the battles of Seneffe (1674) and St. Omer (1677), but was still able to keep the enemy in check. In 1677 he was married, and the Peace of Nijmegen followed in 1678. For some years subsequent to this the policy of William was directed to curbing the power of Louis XIV, and to this end he brought about the League of Augsburg in 1686. As his wife was heir presumptive to the English throne, he had kept close watch upon the policy of his father-in-law, James II, and in 1688 he issued a declaration recapitulating the unconstitutional acts of the English king, and promising to secure a free Parliament to the people. Being invited over to England by some of the leading men, he arrived suddenly at Torbay (5th Nov., 1688) with a fleet of 500 sail, and with 14,000 troops. Upon landing, a great part of the nobility declared in his favour, and in December James fled with his family to France, after which William made his entry into London. The throne was now declared vacant, the Declaration of Rights was passed, and on 13th Feb., 1689, Mary was proclaimed queen and William king. Scotland soon afterwards followed England's example (with a partial resistance under Dundee); but in Ireland, whither Louis XIV sent James with an army, the majority of the Catholics maintained the cause of the deposed king, until they were defeated at the Boyne (1690) and at Aughrim (1691). In the war with France William was less successful; but although he was defeated at Steinkirk (1692) and Neerwinden (1693), Louis was finally compelled to acknowledge him King of England at the Peace of Ryswick in 1697. In 1701 James II died, and Louis XIV acknowledged his son as King of England. England, Holland, and the Empire had already combined against Louis, and the War of the Spanish Succession was just on the point of commencing when William died from the effects of a fall from his horse.—Cf. E. S. and M. S. Grew, *The Court of William III*.

William IV, King of Great Britain and Ireland, and third son of George III, born 1765, died 1837. He served in the navy, rising successively to all the grades of naval command, till in 1801 he was made Admiral of the Fleet. In 1789 he had received the title of Duke of Clarence, and in June, 1830, he succeeded his brother, George IV, as king. The great events which render his reign memorable are the passage of the Reform Act, the abolition of slavery in the colonies, and the reform of the poor-laws. He married (1818) Adelaide, sister of the Duke of Saxe-Meiningen, by whom he had no surviving children, but by his connection with Mrs. Jordan, the actress, he had a large family.—Cf. P. H. Fitzgerald, *The Life and Times of William IV*.

William I, German Emperor, and seventh King of Prussia, second son of Frederick William III, born 22nd March, 1797, died 9th March, 1888. He married in 1829 Princess Augusta of Saxe-Weimar; became heir presumptive to the throne of Prussia on his father's death in 1840; was commander of the forces which suppressed the revolutionary movement (1849) in Baden; created regent in 1858, and on the death of the king his brother in 1861 he succeeded to the throne of Prussia. During his reign Prussia defeated Denmark (1864), annexing the Duchies of Schleswig-Holstein; quarrelled with Austria, and engaged in a campaign which ended in the victory of Sadowa (1866); and went with the rest of Germany to war with France in 1870. In this war the operations of the Prussian generals were under the personal supervision of the king. It was at Versailles, during the siege of Paris (18th Jan., 1871), that he was proclaimed German Emperor.

William II, Friedrich Wilhelm Victor Albert, formerly German Emperor and King of Prussia, son of Frederick III and Victoria, daughter of Queen Victoria, born at Berlin 27th Jan., 1859. Educated at Cassel and Bonn, he studied law and political science. In 1881 he married Augusta Victoria, daughter of the Duke of Augustenburg. He succeeded his father on 15th June, 1888, and very soon gave evidence of self-assertiveness and a restless mind. Throughout his reign he steadily strove to establish a personal rule, untrammelled by ministerial control. He dismissed Prince Bismarck in 1890, and subsequently to all intents and purposes ruled himself, his chancellors being merely his tools. He decided to obtain for Germany ‘ a place in the sun ’, and encouraged German colonial expansion. Having declared that Germany's future lay on the water, he built a powerful navy. Although he frequently pretended that he was anxious for peace, he decided on war in 1914, when he thought that the German army was invincible (see *European War*). Germany having been beaten, he was compelled to abdicate on 9th Nov., 1918, and fled to Amerongen, in Holland. His wife died on 11th April, 1921, and he married again in 1922. See *Germany*.

William the Silent, Count of Nassau and Prince of Orange, eldest son of William, Count of Nassau, born in 1533, died in 1584. He had large estates in the Netherlands, and held high offices under Charles V and his son, Philip II; but the reckless persecution of the Protestants roused him against the Spaniards, and when the Duke of Alva with a Spanish force was sent to subdue the Netherlands (1567) he retired to Germany. Although educated in the Roman Catholic faith, he declared himself a Protestant, and personally led an army into Brabant against Alva, but failed to bring about an engagement. In 1572 the Estates appointed the prince stadtholder of Holland, Zealand, Friesland, and Utrecht, with power to prosecute the war against Spain. He acted as leader of the revolt until his death, and it was by his political prudence that the five northern provinces joined in the Union of Utrecht (1579), and thus laid the foundations of the Republic of the United Netherlands. To check this growing power Philip set a price of 25,000 gold crowns upon the head of the prince, with the result that his life was attempted in 1582 at Antwerp, and he was ultimately assassinated at Delft by a fanatic named Balthasar Gerard.

Williamsport, a city of Pennsylvania, United States, the county seat of Lycoming county, on the west branch of the Susquehanna; served by the Pennsylvania and other railways. It is a favourite summer residence, and the centre of a large lumber trade. Settled in 1795, it became a city in 1866. Pop. (1920), 36,200.

Williamstown, a seaport of Victoria, Australia, on the south-west shore of Hobson's Bay, immediately opposite Sandridge (Port Melbourne), and 9 miles by rail from Melbourne. The piers are commodious, and there are shipbuilding yards, patent slips, the Alfred Graving Dock, and Government workshops. Pop. 18,000.

Williman'tic, a town of the United States, in Windham county, Connecticut, an important railroad and industrial centre. Pop. 11,230.

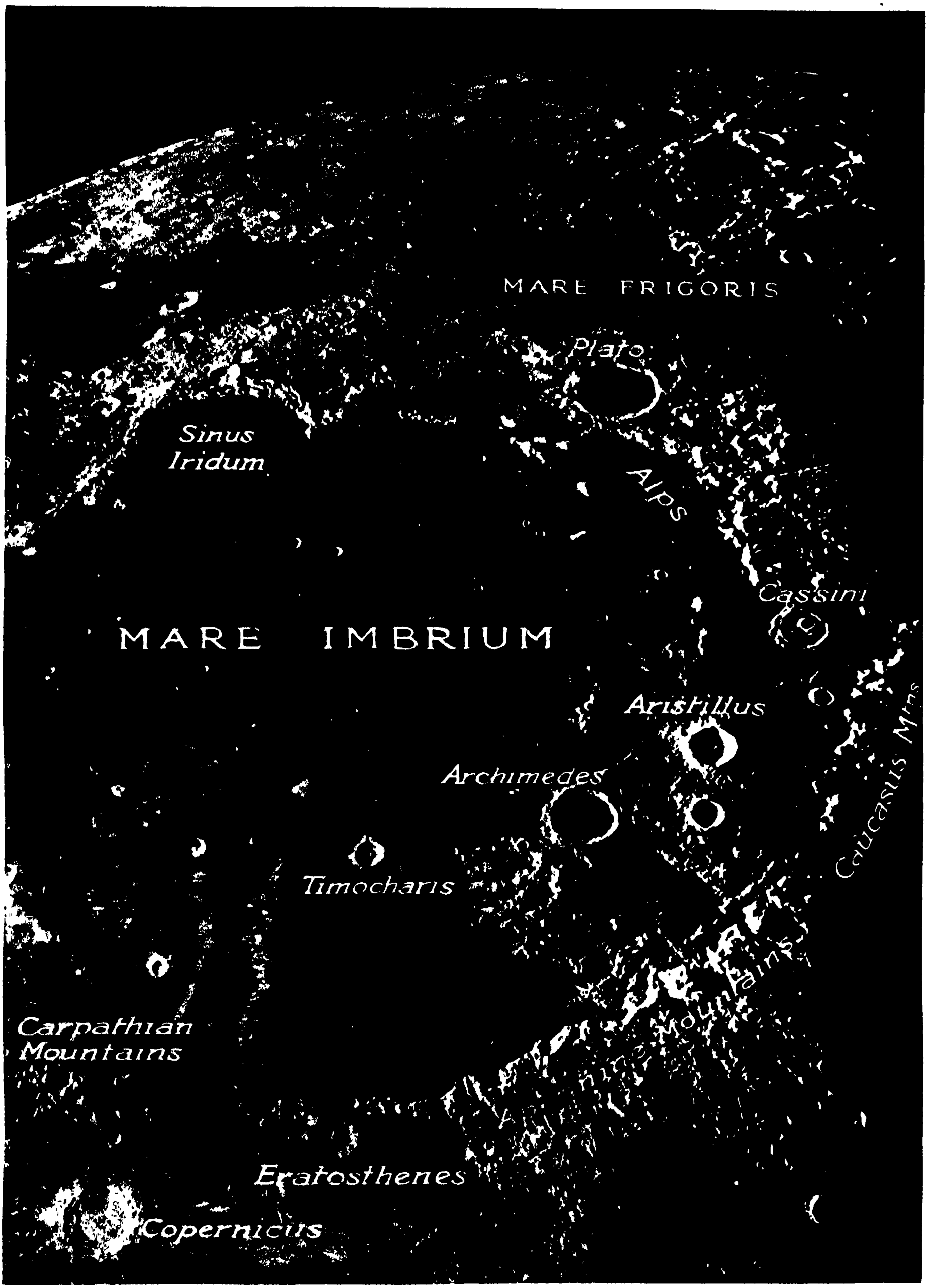
Willow, the common name of different species of plants belonging to the genus Salix, the type of the nat. ord. Salicaceæ. The species of willows are numerous, about 160 having been described, many of which are British. They are all either trees or bushes, and grow naturally in a moist soil. On account of the flexible nature of their shoots, and the toughness of their woody fibre, willows have always been used as materials for baskets, hoops, crates, &c. The wood is soft, and is used for wooden shoes, pegs, and the like; it is also much employed in the manufacture of charcoal, and the bark of all the species contains the tanning principle. The Huntingdon or white willow (*Salix alba*) and the Bedford willow (*S. Russelliana*) are large trees, yielding a light soft timber, valuable for resisting the influence of moisture or damp. The weeping willow (*S. babylonica*) is a native of China, and is a fine ornamental tree.

Willow-grouse. See *Ptarmigan*.

Willow-moth, a species of mouse-coloured moth (*Caradrina cubicularis*), the hinder wings of which are pure white. The larvæ feed on grains of wheat, often doing much damage in ricks.

Willow-wren (*Phylloscopus trochilus*), one of the most abundant of the warblers, and a summer visitant in Britain, with a pleasing song. The general colour is dull, olive-green above, the chin, throat, and breast yellowish-white, and the belly pure white.

Wilmington, a city of Delaware, United States, near the Delaware between Brandywine and Christiana Creeks. It is regularly built, and has a Government building, city hall, court-house, shipyards, cotton-factories, iron-foundries, rolling-mills, potteries, tanneries, powder-works, and an extensive trade. Pop. (1920), 110,168.



Part of the Moon's Surface photographed at Mount Wilson Observatory
Scale about 2½ feet to the moon's diameter

Wilmington, a city and port of entry of North Carolina, United States, the county seat of New Hanover county, on Cape Fear River; served by the Seaboard Air and Atlantic Coast Railways. It is the largest town in the state, has turpentine-distilleries, machine-shops, &c., and exports large quantities of cotton and lumber. Pop. (1920), 33,372.

Wilson, Sir Henry Hughes, British soldier, was born in 1864, and died in 1922. He was educated at Marlborough, and entered the army in 1884. After serving a few months with the Royal Irish Regiment, he transferred to the Rifle Brigade. He took part in the Burma expedition (1886–8), and in South Africa (1899–1901). From 1901 to 1906 he was employed at the War Office; from 1907 to 1910 he was commandant of the Staff College; and from 1910 to 1914 he was Director of Military Operations at the War Office. He was in close touch with the French army, and did much to facilitate co-operation between the French and the British during the European War. He became Deputy-Chief of the General Staff at the outbreak of war; and was in turn principal liaison officer, commander of the 4th Corps, British Military Representative on the Supreme War Council at Versailles, and (1918) Chief of the Imperial General Staff. He played a prominent part in the victorious campaign which ended the war, and in 1919 was promoted field-marshal, created a baronet, and given a grant of £10,000. In Dec., 1921, he resigned his position at the War Office, and was elected member of Parliament for North Down in Feb., 1922. He was a loyal son of Ulster, and not only gave the Government of Northern Ireland expert advice on the measures necessary to maintain order within its area, but also never ceased to denounce in the Imperial Parliament the surrender of the Government to Sinn Fein. Sir Henry Wilson was murdered on 22nd June, 1922, outside his house in Eaton Place, by two supporters of the 'Irish Republic', who were caught after a struggle and eventually hanged. Sir Henry was a man of wide culture, as well as of a fearless disposition; and there is little doubt that he contributed at least as much as any one man did to the Allies' victory in the European War.

Wilson, John, Scottish author, better known in literature as 'Christopher North', was born in Paisley 1785, died 1854. He was educated at Glasgow University and Magdalen College, Oxford. Having lost his fortune, he was called to the Scottish Bar (1815), settled in Edinburgh, and was long a chief contributor to *Blackwood's Magazine*, started in 1817. In 1820 he was appointed to the chair of moral philosophy in Edinburgh University, a position which he held until 1851. Besides his numerous magazine articles, the most characteristic of which were some of the *Noctes Ambrosianæ* and those published subsequently as the *Recreations of Christopher North* (1842), he wrote three tales, *The Lights and Shadows of Scottish Life* (1822), *The Trials of Margaret Lindsay* (1823), *The Foresters* (1824), and *An Essay on the Genius and Character of Burns* (1841).

Wilson, Richard, English landscape-painter, born 1714 in Montgomeryshire, died 1782 at Llanberis. His work is based upon the classic formula of Claude, but shows a quite individual romantic feeling of its own. Wilson is well represented in the National Gallery by *The Villa of Mæcenas* and other works.

Wilson, Thomas Woodrow, twenty-eighth President of the United States, was born in 1856. Educated at Princeton, he published (1885) his thesis *Congressional Government: a Study of Government by Committee*, which achieved an immediate success. In 1890 he was appointed professor of jurisprudence and political economy at Princeton, and elected president in 1902. A Democrat in politics, he was nominated Governor of New Jersey in 1910, and during his governorship became known as an able politician and progressive statesman. The Democratic party now nominated him for President of the United States, and he was elected by a large majority in 1912. Two of his acts in foreign policy were the refusal of his Government to recognize Huerta as President of Mexico, and the recognition of the Chinese Republic. At the beginning of the European War President Wilson was in favour of strict neutrality as far as the United States was concerned, and opposed demands for greater military preparedness. On 4th Aug., 1914, he sent an offer of mediation to Britain, France, Russia, and Germany, and made several other unsuccessful attempts at mediation. Wilson was elected to a second term of office in Nov., 1916, the unsuccessful candidate being Charles Evans Hughes, ex-Governor of New York. By this time his hopes that the United States could maintain an armed neutrality proved vain, especially in view of the methods adopted by Germany in her submarine warfare. On 2nd April, 1917, therefore, he summoned an Extraordinary Session of Congress, and made the proposal that the United States should declare war against Germany. On 8th Jan., 1918, in an address to Congress, he defined his programme for the world's peace in his famous 'fourteen points', in the last of which he urged the formation of a League of Nations (q.v.). When the Armistice was concluded, Wilson sailed for France, and on 14th Dec., 1918, arrived in Paris. His task at the Peace Conference was not an easy one, and he certainly did not succeed in making the Allied Powers adopt *all* his fourteen points.

As he had set his heart upon fashioning a League of Nations, he had to make repeated concessions in order to enlist the sympathy and support of his associates. In the meantime his health had given way, and, when the Treaty of Versailles was at last signed, he returned to the United States. At home he encountered strong opposition from the Republican majority of the Senate, who bitterly criticized the terms of peace and objected to the Covenant of the League of Nations, and, under the severe strain, his health broke down, and he retired into private life in March, 1921. He died 3rd Feb., 1924.

His works include: *Division and Reunion, 1829–89* (1893 and 1909); *A History of the American People* (1902); *Constitutional Government in the United States* (1908); *On Being Human* (1916); *International Ideals* (1919); and *The Hope of the World* (1920).—Bibliography: H. J. Ford, *Woodrow Wilson: the Man and his Work*; H. Wilson Harris, *President Wilson: his Problems and Policy*; D. Halévy, *President Wilson*; C. Sheridan Jones, *President Wilson: the Man and his Message*.

Wilton, a market town of Wiltshire, England. It has an ornate Romanesque church, and is famous for carpets. Wilton House is the ancient seat of the Earls of Pembroke. Pop. (1921), 2024.

Wilts, or **Wiltshire**, a south-western county of England, bounded by the counties of Gloucester, Somerset, Dorset, Hants, and Berks; area, 864,101 acres. It is of a compact and nearly quadrangular form, and is divided by the Upper Avon and Kennet, and the canal between them, into north and south divisions. The north is flat and fertile, and includes Marlborough Downs, upon which is the stone circle of Avebury, while in the south division is Salisbury Plain, an elevated table-land, for the most part unenclosed and uncultivated, on which are the remains of Stonehenge, about 9 miles north of Salisbury. The strata of the county are principally cretaceous, belonging to the great central chalk district of England; and the chief rivers are the Kennet, and the Upper and Lower Avon. The larger proportion of the surface is in pasture, devoted chiefly in the south division to the rearing of sheep, and in the north to cattle-grazing and dairying. Wiltshire bacon and cheese are famous. Manufactures comprise woollen goods, for which the principal localities are Wilton, Bradford, Trowbridge, and Westbury, excellent cutlery and steel goods at Salisbury, ropes and sacking at Marlborough, iron-founding at Devizes, and there are great railway works at Swindon, the largest town. Salisbury is the county town. Pop. (1921), 292,213.

Wimbledon, a municipal borough of Surrey, England, 7 miles south-west of London, at the north-east extremity of Wimbledon Common. Pop. (1921), 61,451.

Wincey, a strong and durable union cloth, plain or twilled, often composed of a cotton warp and a woollen weft. Heavy winceys have been much worn as skirtings and shirtings. The name is probably a contraction of linsey-woolsey, which would doubtless be made from flax yarns and wool yarns originally.

Winch. The windlass used to lift water from a well is a simple barrel winch. To obtain greater mechanical advantage, a gear-wheel is placed on the drum of a winch, and a pinion on the shaft of the turning-handle. The addition of other trains of wheels gives further advantage. Band brakes are commonly fitted to prevent running back. Electrical- and steam-driven winches are used for the heavy loads of ships' cargo and on such devices as jib cranes.

Winchester, an ancient city of Hampshire, England, on the Itchen. The most important edifice is the cathedral, originally built in the latter half of the eleventh century. It is in the form of a cross; length from east to west, 545 feet; width of the transepts, 208 feet. Besides being in itself of great architectural importance, it contains numerous monuments of historical interest: as the tombs of William Rufus, of Edmund, son of King Alfred, and of Izaak Walton; the golden shrine of St. Swithin; bronze figures of James I and Charles I, &c. The other important buildings and institutions are: St. Mary's College or Winchester College, founded by William of Wykeham in 1387, the oldest of the English public schools; the castle; Victoria Hospital; barracks; and the Hospital of St. Cross, founded in 1132. Pop. (1921), 23,791.

Winchester was the capital of Wessex (q.v.), and when the kings of Wessex became kings of all England, it became the capital of England. Its importance declined after Normandy was wrested from King John (1203).

Wind, air in motion. Winds are classified as constant, periodical, and variable. The most general features of the atmospheric circulation are yet far from completely understood. The salient fact is a rarefaction and rising of the air over the heated equatorial regions. Winds are drawn in from both hemispheres to supply its place, and these, being diverted in a westerly direction by the earth's rotation, form the north-east and south-east trade winds, an example of constant winds. They blow from near the calms of Cancer and Capricorn, the situations of which are called the Horse Latitudes, about 30° north and south latitude. The rising equatorial air flows in the higher atmosphere as return currents above and opposite to the lower trade winds. At the Horse Latitudes it descends, partly to return as the trade winds and partly to travel as a surface wind to higher latitudes. The latter part forms our prevailing south-westerly winds, and the more persistent north-west winds of the 'roaring forties' (latitudes 40° to 49° s.). The circulation described above is subject to great interruption over the continental masses. In the northern winter months Central Asia becomes extremely cold and a centre of high pressure. This causes an outflow of wind over Southern Asia from the north-east. In the northern summer the same region is extremely warm, with low pressure. South-west winds then blow over the northern Indian Ocean. This is an example of periodical winds—the north-east and south-west *monsoons*. In temperate regions, particularly in the northern hemisphere, we find variable winds, due largely to the prevalence there of cyclonic depressions, or centres of low pressure, round which the winds circulate, and which travel over the ocean and land surface. The depression as it travels does not remain constituted of the same air, but is continually taking in new air and leaving behind its former contents. By study of the actual path of an air particle from place to place the original source of the wind blowing at a certain time and place has in some cases been traced, and found to explain satisfactorily the state of temperature or humidity which it produced. In general the wind is strongest at the hottest part of the day, and weakest at night. This is connected with the fact that wind velocity is greater at an altitude than at the surface, where the speed is reduced by friction. In the daytime there is more inequality of temperature at different points of the surface, due to solar heating. Any heated spot has over it an ascending current. Thus there is in the daytime more vertical interchange between the lower and higher air. This imparts to the lower some share of the greater horizontal velocity of the upper air, causing an increase of the wind near the surface.

Land and Sea Breezes.—The air over the land is colder during the night than the air over the sea. There is therefore a flow of air from sea to land in the upper regions of the atmosphere, so that pressure rises over the land, and the air at lower levels flows seawards. This is the 'land breeze'. During the day a similar process with reversed conditions gives rise to the 'sea breeze'. —BIBLIOGRAPHY: W. Ferrel, *A Popular Treatise on the Winds*; A. E. M. Geddes, *Meteorology*; Sir Napier Shaw, *Manual of Meteorology*.

Windermere, the largest sheet of water in England, and renowned on account of the beauty of its scenery, is partly in Westmorland and partly in Lancashire. It is about 11 miles long, and averages 1 mile in breadth.

Windham, William, English statesman, born 1750, died 1810. After being educated at Eton, Glasgow, and Oxford, he was returned to Parliament (1784) as member for Norwich. He became Secretary of War in 1794, and remained in this position until the retirement of Pitt in 1801; took office again in the Grenville administration (1806), and brought forward a Bill to limit the term of service in the army, as also to increase the pay and pensions of officers and men; retired from office (1807), and strenuously opposed the Copenhagen and Walcheren expeditions.

Windhoek, a town of the South-West Africa Protectorate, the administrative centre and the former capital of German South-West Africa. At an altitude of 5456 feet, it has a mean annual temperature of 67° F. (January, 74·5°; June, 56° F.) and a rainfall of 15 inches. Grootfontein (5020 feet altitude) has a mean rainfall of 24 inches. January is the rainiest month in both places. Klein Windhoek, a German colonial settlement, is noted for its five hot springs (104° to 127° F.), one of which has a temperature of 170° F. Pop. of the district, about 17,000 (about 4000 whites).

Wind-instruments. It is customary to confine the term wind-instrument to those which are sounded by the breath of the performer. Though the earliest of musical discoveries, wind-instruments as used in the military bands and symphony orchestras of to-day are less than a century old. The difficulties to be overcome in connection with their development arose from the fact that the vibrating column of air, which is in every case the medium of sound production, does not of itself give a continuous series of sounds according to any scale, but can provide only the sounds of the harmonic series, or 'chord of nature'. No instrument which could produce these notes alone can be of any but a strictly limited use in music, and the disadvantage is increased by the fact that some of the notes are slightly out of tune with the corresponding sounds of the accepted scale-systems. It must be remembered that every note in music has its own harmonic series, exactly corresponding to that given for C. This fact, combined with the other equally important fact that any instrument can be made to yield another note than its own by altering the length of the vibrating column of air, furnished the ultimate solution of the difficulty of providing an unbroken scale in wind-instruments.

The most usual and most practical method of classifying wind-instruments is according to the manner in which the column of air is made to vibrate by the lips of the player. This method yields three great classes, those of flute, reed, and brass.

Instruments of the flute class are composed of an open cylindrical tube, or a series of them, as in the case of Pan's pipes, and the air column is made to vibrate by blowing across the end, as in Pan's pipes, by blowing through a slit at the top, as in the penny whistle, or sideways across a mouth-hole, as in the orchestral flute. The length of the vibrating column is varied by opening with the lifted finger, or some more or less elaborate mechanism, a series of holes placed laterally in the tube at carefully calculated intervals. The natural scale of the instrument is limited to one octave, but by blowing slightly harder and altering the angle of the stream of air from the player's lips the pitch of the instrument leaps an octave higher, and a further application of the same means alters the pitch yet another octave.

Reed-instruments are of four classes, those with single reed and cylindrical tube (clarinets), single reed and conical tube (saxophones), double reed and cylindrical tube (no examples in modern use), and double reed and conical tube (oboe, cor anglais, and bassoon). The reeds in these instruments are directly controlled by the player's lips, the principles of sound production being otherwise the same as in instruments of the flute class, excepting that all members of the clarinet family ' overblow ' a twelfth, and not an octave.

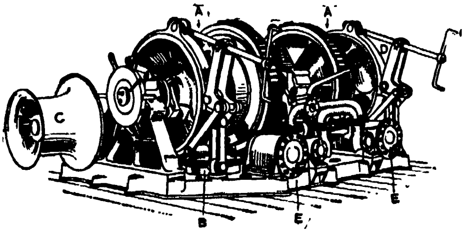
In brass instruments the length of the tube plays an important part, a short tube giving more readily the lower harmonics of the natural series (bugle, post-horn), while the upper harmonics, which it will be noticed are much closer together than the lower ones and therefore more generally approximating to a musical scale, are more easily produced from a long tube (trumpet, French horn). For an explanation of valve action and its functions in connection with these instruments, see *Trumpet.* In the trombone, and less commonly in the trumpet, the necessary variations in length of the air column are secured by means of a slide. As the shape of the tube has no effect on the tone, the very considerable length of tubing required in horns, trumpets, and trombones is brought within convenient and practical limits by bending it into the curved patterns familiar to all. The general arrangement of wind-instruments in an orchestral score is as follows, beginning at the top: piccolo, flutes, (bass flute), oboe, cor anglais, clarinets, (bass clarinet), bassoons, double bassoon, horns, trumpets, trombones, tuba. See Plate of Musical Instruments at *Music.*

Windlass, a form of the wheel and axle (q.v.) mechanism used for raising comparatively small loads. The simple hand-turned drum for lifting a bucket of water from a well is an example. It is commonly provided with a pawl to prevent it from turning backwards if the effort is removed.

Windmill, a mill which receives its motion from the impact of wind upon sails or vanes, and which is used for grinding corn, pumping water, &c. The surfaces of the sails or vanes must be oblique to the wind's direction, so as to produce a rotary movement when struck by it. The windmill is often a conical or pyramidal tower. The wind is made to act upon sails or vanes attached by means of rectangular frames to the axle or *wind-shaft* of the mill. This axle is placed nearly horizontal, so that the sails by the pressure of the wind revolve in a nearly vertical plane, thus giving a rotatory motion to the driving-wheel fixed in the wind-shaft. The movement thus produced is transferred by means of bevel-wheels to the main shaft, which is connected with the specific machinery of the mill. Mechanism is provided to secure that the sails shall always face the wind. Windmills used in this country in pumping water have generally a frame support of steel sections and a vane structure similar to, but smaller than, that referred to above.

Windsor, or **New Windsor,** a municipal borough and market town of Berkshire, England, on the Thames, 22 miles west from London, and connected by a bridge with Eton. There are several churches and chapels, barracks, an infirmary, &c. The only manufacture of importance is that of tapestry. Pop. (1921), 20,115.

Windsor owes its chief importance to its castle, which stands east of the town on a height overlooking the River Thames, and is the principal royal residence in the kingdom. It was begun, or at least enlarged, by Henry I, and has been altered and added to by almost every sovereign since. The chief features of interest in the castle are the old State apartments; St. George's Chapel, where the Knights of the Garter are installed, and the vaults of which contain the remains of Henry VI, Edward IV, Henry VIII, Charles I, George III, George IV, and William IV; the Round Tower or ancient keep, and the present State apartments.



Ship's Windlass, driven by Steam and fitted with Hand Brakes

A, A, Chain lifters. B, Chain-pipe. C, Pulley for wire-rope hawser D, Brake gear. E, E, Steam cylinders

Windward Islands, the administrative title of those British West Indian islands lying north of Trinidad and south of Martinique. They are: Grenada, the Grenadines, St. Lucia, and St. Vincent. Geographically Barbados forms part of the group. At Bridgetown (Barbados; 56 feet altitude) the mean monthly temperature is 79·3° F., and the rainfall about 56 inches. St. George's (Grenada) has a mean annual temperature of 79° F., and a rainfall of 76·6 inches. In St. Vincent the mean monthly temperature is 79° F., and the rainfall 79 inches. See *St. Lucia.*

Wines and Spirits. In the Bible frequent reference is made to wine, the fermented juice of the grape, while Egyptian tablets of date 4000 B.C. show that it was then in common use. It is supposed that the first attempts to cultivate and improve the wild vine originated in Persia and gradually spread westwards. Viticulture is known to have been encouraged by the Greeks and Romans in the European countries conquered by them, and in the Middle Ages by missionary monks, who carried it as far as the American shores of the Pacific.

In the northern hemisphere the vine can be grown commercially, i.e. grapes will ripen in the open air, between latitudes 51° and 33°, embracing the greater part of Europe, North Africa, and Asia Minor; and in the southern part of the globe, Australia, South Africa, and Central South America are wine-producing countries. By careful selection, extending over centuries, the varieties of vine best suited to the soil and climate of the different countries have been ascertained. Vines producing black grapes are greatly in the majority.

The manufacture of wine varies in detail, but the essential feature is fermentation of the juice and pulp of the grape, called *must.* Grapes, especially those grown for wine-making, are rich in sugar, and when the crushed fruit, or must, is allowed to stand in a suitable temperature (about 65° F.), the whole mass is soon in active fermentation (q.v.). During this process the bulk of the sugar changes into alcohol and carbonic acid gas. The latter passes off into the atmosphere, but the alcohol remains along with other constituents of the must, viz. water, tartaric acid, tannin, grape-sugar, ethers, and essential oils, the whole forming *wine.* Wines may be either red or white. The colouring-matter of red wine is contained in the skins of black grapes. By itself the wine is blue, but the acids present turn it red. In young wines, where other constituents modify the acids, the colour is almost purple, whereas in older wines it becomes a deep ruby shade. The term *white* applied to wines is hardly correct if milk be taken as an example of a white fluid. They are really yellow, and range from the palest straw to deep golden. White wine can be made from black grapes by withholding the skins, but red wine cannot be made from white grapes.

The more important wines used in this country may be divided into the three main classes of *natural, fortified,* and *sparkling* wines. *Natural wines* are those resulting from the natural and complete fermentation of grape-juice without the addition of any other substance, and form the great bulk of wine produced in the world. They are mostly consumed in the countries of production; of those imported into the United Kingdom the following are the chief.

Claret, a red wine produced in the south-west of France, in the department of Gironde, in the neighbourhood of Bordeaux. The name claret is only applied to this wine in English-speaking countries, and has no justification except centuries of use. In France it is known as Bordeaux red wine. The region of production is divided into three large districts, Médoc, Graves, and St. Emilion, and these are subdivided into numerous communes or parishes, of which the best known are St. Julien, St. Estèphe, Margaux, and Pauillac. French claret shares with burgundy the distinction of being the finest wine of its kind in the world. Claret is light, containing only about 10 per cent of alcohol. It has a delicate and attractive flavour, being neither too sweet nor too dry; its 'bouquet' or aroma is pleasing, it possesses tonic and digestive properties, and it keeps and improves in bottle. About the year 1852 a jury, composed of the leading members of the Bordeaux wine trade, made a classification of the vineyards of the Médoc according to quality. Fifty-nine wines, designated *classed growths,* are divided into five classes, and include such famous names as Château Margaux, Château Lafite, Château Larose, Château Léoville, Château Mouton Rothschild, Château Pontet Canet, and many others.

After the classed growths come *bourgeois, paysan,* and *artisan,* in the order named. The Graves and St. Emilion wines include many which rank equal to the classed growths. Château Haut Brion, a Graves wine, ranks with first-classed growths, and some of the best St. Emilion wines bring prices equal to the second growths of the Médoc. Most of the proprietors of well-known growths bottle their wines at the château with branded corks, thus affording a guarantee of authenticity. Like all crops depending on natural conditions, the quality of vintages varies from year to year, so that, while a first growth of a successful vintage will be a magnificent wine, the same château of an inferior year may be very poor in quality. The most famous claret vintages are 1864, 1874, 1875, 1898 (when the vintage was the largest for many years), 1899, and 1900. There has been no outstanding vintage since, although 1906, 1911, and 1914 are considered good. Good claret will keep many years in bottle (1874's are to this day magnificent wines), but when a bottle is opened it should be used quickly, as a couple of days' exposure to the air will turn it flat. It should be kept in cellar at a minimum temperature of 50° F., and used at about 60°. This applies to all *red* wines.

A large quantity of *white wine* is made in the neighbourhood of Bordeaux, mostly to the south-east in the districts of Graves, Sauternes, Barsac, and Preignac. Those wines are very popular in Britain. The Graves are mostly dry, some of the better qualities possessing a most attractive flavour, while the cheaper kinds make very agreeable table wines. In the other districts the wines are sweeter, the fine kinds being distinctly so. While they show extraordinary bouquet and flavour, their richness is somewhat cloying to the palate, and they are less in demand in this country than the drier kinds. In Sauternes is situated the famous vineyard of Château Yquem. In a fine year this wine is so rich and luscious as to be almost a syrup, while the bouquet and flavour are unique. Previous to 1914 the average annual output of the Gironde was roughly 82 million gallons, of which about 10 per cent was exported to Britain, where the duty payable was, in 1922, 2*s*. 6*d*. per gallon.

Burgundy is also the produce of France, the vineyards being situated in the east, in the departments of Yonne, Saône and Loire, and Côte d'Or. The principal districts are Mâcon, Beaujolais, and Côte d'Or, this latter producing the finest and most renowned red wines. The principal towns of the region are Dijon and Beaune, the latter being the centre of the wine trade. The ordinary wines of Burgundy are stouter, rougher, and sweeter than claret. The finest kinds are more delicate, and have a velvety softness on the palate, combined with very pleasing aroma and delicious flavour. The alcoholic strength runs about 12 per cent. The vineyards in Burgundy are, as a rule, smaller than in the Bordeaux region, and are usually divided among several owners. On this account Burgundies are generally sold in this country under the names of districts, such as Beaune, Pommard, Nuits, and Volnay. The finest wines are, however, sold under the names of their respective vineyards, viz. Romanée-Conti, Chambertin, Clos de Vougeot, Richebourg, La Tache, &c.

White wines, known in this country as Chablis, are made in the commune of that name, and are very good; but the finest white wine is considered to be Montrachet, from the commune of Puligny, next to it coming Meursault. The finest vintages of Burgundy are 1874, 1885, 1898, 1904, 1911, 1915, and 1919. The average production is about 10 million gallons per annum.

Hock is the name applied in this country to German white wines grown on the banks of the Rhine and its tributaries. They are full-bodied, soft, and fruity, and have an attractive aroma. The alcoholic strength is about 12 per cent. The finest kinds are made in the district named Rheingau, extending on the right bank from Biebrich to Rüdesheim. There we find the famous vineyards of Steinberg, Schloss Johannisberg, Marcobrunn, Rüdesheim, &c. In the neighbourhood of Bingen are situated Nierstein and Oppenheim, which produce lighter and cheaper wines. Close to the town of Worms is the well-known vineyard of Liebfraumilch. Farther south, the Palatinate district produces softer and riper wines, but not so highly flavoured, such as Forst and Deidesheim. Red wines are made, the best being Assmannshausen, but they are little known here. The best vintages are 1884, 1893, 1904, 1911, 1915, and 1917.

Moselle wines are produced on the banks of the river of that name. They are much lighter and thinner than hock, and generally have a slightly acid taste, but the bouquet is highly developed, and in the finer qualities very attractive. Among the best known are Berncastler Doctor, Brauneberg, Zeltingen, and Piesport. A considerable quantity of wine similar to hock and Moselle is produced in the province of Alsace. During German possession, this was largely blended with Rhine and Moselle wines and shipped from Germany as hock and Moselle. The territory being now French, growers are sending their wines to this country under their own geographical names, and already some very good samples have been shown.

Italian Wines.—In this warm southern climate the vine flourishes vigorously, and the quantity of grapes produced is enormous. Unfortunately the quality does not improve in like manner, the wines having a strong, slightly rank flavour, while the dry varieties are inclined to be astringent, and the sweet very rich. Of late years considerable attention has been paid to cultivation, and quality shows improvement. They are useful where a stout beverage wine is wanted. The best known of the red wines are Chianti, grown in Tuscany; Barolo, in Piedmont; and Lachrymæ Christi, from the slopes of Mount Vesuvius, near Naples, a wine of great reputation, rich and fine flavoured. Near Naples we also get Capri red and white, of which the latter is the more esteemed. The quantity of Italian wine imported during 1921 was 330,000 gallons; alcoholic strength, about 15 per cent; duty, 3*s*. 6*d*. per gallon.

Spain produces an enormous quantity of wine, both red and white. The greater part of our import comes under the heading of fortified wine, but we may notice Rioja, grown in the north near Bilbao, and Val de Peñas, both beverage wines similar to claret, but harsher and more astringent in taste. *Austro-Hungary* also grows a large quantity of wine, mostly common in quality, which is consumed in the country. A red variety, Carlowitz, of the claret type, was formerly imported in small quantities. In the east of Hungary is made the famous Tokay, a rich golden wine of the liqueur type, which in a good year brings a high price. In the north of Africa, *Algeria* provides an important quantity of ordinary wine. By careful selection of suitable vines and scrupulous attention to manufacture, growers have greatly improved their quality within the last thirty years, and now, price for price, they compete very closely with the cheaper kinds of French wine. The bulk of the product goes to France. In 1914 the quantity made of both red and white was 226 million gallons. In the south, in *Cape Colony*, the soil and climate are very suitable for viticulture, and in the seventeenth century this industry was started by Huguenots expelled from France. For a long period wine of common quality was produced and consumed locally. In the early part of the nineteenth century the British Government took the matter in hand and spent considerable sums in fostering the trade, besides granting a low import duty into Britain. This led to consumption here on a fairly large scale, but later in the century this preferential duty was discontinued, and exports fell off. The annual production is about 75 million gallons, and is mostly consumed in the country, but recently efforts have been made to secure a footing on the British market. Both red and white wines are made, the most esteemed being Constantia, grown close to Cape Town. In 1921 Britain imported 41,000 gallons; strength, about 12 per cent; preferential duty, 1*s.* 6*d.* per gallon.

In *America* the wines of California were of most interest to our market, but under prohibition the manufacture has ceased. In *South America*, Chile and the Argentine produce large quantities of wine, which are entirely consumed on that continent and rarely exported to Europe.

Australia.—The cultivation of the vine in Australia is of comparatively recent date, having commenced about the year 1830. In many parts of that continent soil and climate are favourable, the principal drawback being drought and heat, which make great care in cultivation and manufacture necessary. The output previous to 1914 was about 6 million gallons annually. Australian wines are thick, soft, and heavier than European wines, but suitable for beverage purposes. They are handicapped in price by high cost of labour and freight, although this is counterbalanced to some extent by scientific manufacture and a preferential duty. Both red and white wines are made, and of all types. The quantity imported in 1921 was 544,000 gallons.

Among *fortified wines* the most important is *port*. This is a red wine grown on the hilly banks of the upper part of the River Douro, in Portugal, and shipped from Oporto, whence its name. In its manufacture fermentation of the must is arrested by the addition of brandy made from commoner wines of the country. If a sweet wine be desired, the addition is made before fermentation has proceeded far, and sugar is thereby retained; if, on the contrary, a dry wine be wanted, fermentation is allowed to continue longer. Port as shipped to Britain generally contains about 20 per cent alcohol, and duty is 6*s.* per gallon (1922). This high proportion of alcohol, along with the stout, rich nature of the wine, renders it very suitable for the comparatively cold, damp climate of this country, where it has for centuries enjoyed great popularity. The wine trade in Oporto is largely in the hands of English firms, descendants of merchants who settled there about the seventeenth century. In contrast to the custom of selling claret and burgundy under the names of the different châteaux or districts, ports are blended by the shippers and sold under their names, with marks attached denoting quality. Very few wines of particular vineyards, or *quintas* as they are called, are sold individually. In the Douro district, as elsewhere, the quality of the produce of the vineyards varies from year to year. When a particularly favourable year occurs and quality is really fine, a blend of wines of that year alone is shipped very early to Britain, and put into bottle at once. This must be done within two or at most three years after the vintage. This is known in the trade as vintage wine, and represents the finest type of port it is possible to get. It requires a considerable period in bottle to mature properly, but will keep a long time, some vintages previous to the Phylloxera devastation in the 'eighties having lived fifty years and more. Wines of subsequent years, having been made from replanted vineyards and younger vines, while showing equally fine quality in their youth, do not appear to have the long life of the older wines, and thirty years seems to be about their limit. The finest vintages are 1847, 1863, 1870, 1878, 1887, 1890, 1896, 1900, 1904, 1908, 1912, 1917; and of these 1896 and 1908 are outstanding. In ordinary years, when quality is not so exceptional, the wines are stored in casks by the shippers in their cellars or 'lodges', and allowed to mature there. During this process the wine, while improving in quality, loses colour and body, and when very old becomes reddish-brown in colour, or what is known as 'tawny'. These wines are lighter, and to some palates more suitable and agreeable, than the very robust and heavy vintage wines.

White port is also made, and a considerable quantity imported, but the wines are wanting in the characteristics of the red varieties, and are not so attractive. Outside the Douro district, a large quantity of wine is made in Portugal, and a considerable quantity is exported to Britain. It is known as Lisbon Red, and is commoner and wanting in the fine flavour of genuine port. By a treaty between Britain and Portugal only wine from the Upper Douro can be sold as port in this country. The quantity of wine imported from Portugal during 1921 was altogether about 4½ million gallons, and in 1913, 3½ million gallons. In 1919 imports reached the enormous figure of 13 million gallons. *Sherry* is a white wine made in the south-west corner of Spain, in Western Andalusia, the centre of which is Jerez, whence the wine takes its name. In its manufacture the must is allowed to ferment naturally, but the peculiarity of sherry is that a second slow fermentation takes place in the cellars (or *bodegas* as they are called), lasting for eighteen to twenty-four months. This second fermentation is very uncertain in its action. For example, out of ten casks of new wine all made from the same grapes and in exactly the same way, there may be found at the end of two years one or two casks of pale, delicate, sweet wine; one or two of the same colour but dry; one or more of dark-coloured, full-bodied wine; and perhaps one that is of no use whatever. This seems to be a natural process which cannot be controlled. The pale, delicate, dry wines are called 'fino' (or 'palma'), the fuller-bodied dry wines 'cortado', and the darker-coloured and richer wines 'raya'. These different varieties are blended, and fortified by the addition of brandy before shipment, and are generally sold in Britain under names such as Vino de Pasto (light colour, delicate dry flavour), Amontillado (very dry, with more body), Oloroso (full golden colour and soft rich flavour), East India (dark colour, sweet full body), Manzanilla (very dry, with flavour of camomile flowers), &c. The alcoholic strength is about 20 per cent, and duty 6*s*. per gallon. The average importation into Britain is slightly over 1 million gallons. One feature which may be noticed is that sherry keeps better after being opened and exposed to the air than any other wine.

Malaga, shipped from the port of that name, is a white wine grown in Eastern Andalusia. It is different in style from sherry, being generally sweeter. It is not much used in Britain. *Tarragona* is a red wine grown in Catalonia, and largely exported to this country. It somewhat resembles port in character, but is much inferior in quality and cheaper in price. In 1921 the quantity of this and similar red wines imported from Spain was close on 1½ million gallons. *Marsala* is a white wine produced in the island of Sicily, resembling sherry, but softer and more fruity. It was largely used in the British navy for many years. One of the leading houses in Palermo has in its possession an order for this wine signed by Lord Nelson. The quantity imported is not large; alcoholic strength, about 20 per cent; duty, 6*s* per gallon. *Madeira* is produced in the island of that name, the soil of which consists of disintegrated lava, and is peculiarly suitable for the vine. Madeira has a very pronounced and distinctive flavour, besides being full and soft. It varies in colour from pale golden to dark brown, and will keep for many years in bottle. The quantity imported in 1921 was 83,000 gallons; strength, 20 per cent alcohol; duty, 6*s*. per gallon. *Vermouth*, a white wine flavoured with aromatic herbs, is now largely used in this country. There are two kinds—French (dry), made in the neighbourhood of Marseilles, and Italian (sweet), made in Turin.

Sparkling Wines.—Of these the best known is champagne, made in the north of France, in the department of Marne, with the towns of Rheims and Épernay as centres of manufacture and distribution. This district formed part of the old province of Champagne. It is about as far north as the vine can be cultivated; hence we have a small yield of grapes producing a wine of exceptional flavour and delicacy. The art of retaining natural effervescence in champagne is attributed to Dom Pérignon, of the monastery of Haut Villers, who died in 1715. Great care is necessary in the manufacture; the grapes are examined, and any doubtful or unripe rejected. They are then pressed and the must allowed to ferment. Vintage generally takes place in September, and in spring following the different wines intended to form a blend are mixed together in a large vat. This is called a 'cuvée', and the wine is immediately bottled and corks fastened down. Owing to the quantity of grape-sugar in the must being large, the first fermentation does not completely exhaust it; consequently a second fermentation takes place in bottle, and carbonic acid gas is produced, which cannot escape but is absorbed into the wine, and produces effervescence when poured out. The wine is allowed to mature in bottle until required, when it is prepared for shipment by the removal of any deposit and the addition of a small quantity of liqueur made from old wine brandy and sugar. For the British market, where dry wines are required, ½ per cent of liqueur may be added, while for France or other countries, where a sweeter wine is in demand, as much as 5 per cent may be necessary. Only the finest wines are usually sent to this country, and the best vintages are 1900, 1904, 1906, 1911, and 1914. Champagne of a greater age than twenty years often loses its effervescence, and while the wine may be quite sound and very fine in quality, its stillness renders it undesirable to most people. The alcoholic strength of champagne is about 11 per cent, and duty (1922) is 30*s*. per dozen bottles (2 gallons). The quantity imported in 1921 was 358,000 gallons, against over 1 million gallons in 1918.

In the west of France, in the valley of the Loire, which flows through Touraine and Anjou, a considerable quantity of *white sparkling wine* is made. This is light and pleasant, but wanting in flavour and delicacy as compared with champagne, nor has it the same keeping properties. It is known as Saumur. The quantity imported in 1921 was nearly 33,000 gallons. *Sparkling Burgundy.*—In the Burgundy district a red sparkling wine is made for which there is some demand, 10,000 gallons having been imported into Britain in 1921. Red wines do not adapt themselves to the sparkling state so well as white, the most noticeable difference being to the eye. The clear amber liquid with tiny globules streaming to the surface is much more attractive than an opaque red wine with froth on the surface. *Sparkling hock* and *Moselle* are white wines made in Germany by the same method as champagne. They are coarser and more fruity than the latter, and generally sweeter. The quantity imported in 1921 was about 16,000 gallons. In Italy many sparkling wines are made, the best known here being Asti, but imports are small.

Spirits.—All fermented liquors contain a certain amount of alcohol, and when this is separated from the other constituents by distillation the product is called *spirits.* The art of distillation is not of such great antiquity as the manufacture of wine. The first record extant of its use in the preparation of a beverage is in the eleventh century, and it does not appear to have been introduced into England until the sixteenth century. The product of the early efforts was no doubt crude, nevertheless it was much prized as a medicine, and as methods were gradually perfected the demand increased. The first spirit was made from wine and called *brant wein* (burnt wine) or brandy.

Brandy is the product of the distillation of wine made from grapes. It is produced in almost every country where wine is made, but the finest quality, and what is generally known in this country as brandy, without being distinguished by the country of origin, is made in the west of France round the town of Cognac, on the River Charente, in the department of that name. This region produces a thin, highly flavoured white wine, which on being distilled yields ‘ eau de vie de Cognac ’, a brandy which in point of quality takes precedence over all others. Distillation is effected in pot stills; and when newly made the spirit is colourless. It is stored in oak casks and allowed to mature for many years, during which time the colour becomes deep yellow, and flavour and bouquet, due to essential oils in the spirit, develop in all their perfection. The production in an average year is in round figures 3 million gallons. Brandy is usually sold in Britain at a strength of 30 under proof (Sykes), on which duty in 1922 was 53*s*. 6*d*. per gallon. The quantity of brandy from all sources imported into the United Kingdom in 1921 was 469,000 gallons, and in 1918, 1,490,000 gallons.

Whisky (from Gael. *uisge*, water).—The manufacture of whisky seems to have commenced in the eleventh century in the Highlands of Scotland, and probably soon after in Ireland. Methods were then very primitive, resulting in a coarse and acrid spirit which does not seem to have spread far until the seventeenth century, when it came into use in the Lowlands of Scotland. Scotch whisky is of two main kinds, *malt* and *grain.* The former is made from malted barley in pot stills, and the latter from unmalted grain, generally maize, with a small proportion of malt added, in patent stills (see *Still*). Owing to materials used and method of manufacture, malt whisky is much richer in ethers and essential oils, and is more pronounced in taste and smell than grain whisky, this latter being more neutral. Scotch malt whiskies may be classed in four categories, viz. Highland, Lowland, Islay, and Campbeltown. The difference in each class is very marked, owing to natural causes, such as the quality of the water, and the flavour imparted to the malt by peat used in drying. Whisky is, like all spirit, colourless when newly distilled, but during the process of maturing in casks it acquires a yellowish colour. By law, whisky must be three years old before it can be sold for consumption. Fifty years ago Scotch whisky was little known outside Scotland, but it is now known and largely consumed all over the world. *Irish whisky* is likewise made both in pot and patent stills, the produce of the latter resembling Scotch grain. Owing to the use of a mixture of malt, unmalted grain, and oats, Irish pot-still whisky differs considerably from Scotch, being heavier and sweeter, and having an oily taste as against the clean, crisp, dry flavour of the latter; and outside Ireland it is not so much in demand.

The number of *distilleries* at work in the United Kingdom in 1921 was 164, distributed as follows: England 8, producing 7 million gallons spirits, mostly used for making gin and for industrial purposes; Scotland 133, quantity made 29½ million gallons; Ireland 23, production 11 million gallons. The quantity of whisky consumed as beverage in the United Kingdom during 1921 was 15½ million gallons, and the quantity exported 7½ million gallons. The excise duty on whisky in 1922 was 72*s.* 6*d.* per proof gallon (Sykes). It is generally sold at a strength of 30 under proof (about 40 per cent alcohol), so that duty on a bottle of whisky containing one-sixth of a gallon amounted to 8*s.* 5½*d.*

Gin is a spirit made from grain flavoured with juniper berries and other aromatic substances. Holland is the largest gin-producing country, and Britain comes next, London and Plymouth being the principal places of manufacture. There is a considerable difference in taste between Dutch and English gin, the former having what may be described as a yeasty flavour, while the latter is much cleaner and to most people more attractive. ‘ Old Tom ’ is the name given to English gin which has been slightly sweetened. Gin, being a highly rectified and pure spirit, does not require to be kept like whisky, and is generally used soon after manufacture. As compensation for the compulsory maturing of whisky, gin in 1922 paid a higher duty of 74*s.* per proof gallon.

Rum is a spirit made from molasses, a substance produced in the manufacture of cane-sugar, and is made in all countries where this industry is carried on, but Jamaica and Demerara are the principal sources of supply for Britain. From the rich nature of its source, rum has perhaps the greatest food value of any spirit, and it certainly has the property of imparting a feeling of warmth to the human system; hence its selection for the use of our troops during the European War. It has long been used in the navy. In 1921 the quantity imported into the United Kingdom was over 4½ million gallons. In 1922 duty on rum from British possessions was 72*s.* 10*d.*, and from foreign countries 75*s.* 4*d.* per proof gallon.

Liqueurs are beverages artificially prepared from alcohol, sugar, and an endless variety of flavouring substances. They are very numerous, and we can only notice a few. *Benedictine* is made at Fécamp, in France. *Chartreuse* was formerly made at the monastery of that name near Grenoble, but the monks on removing to Spain carried the manufacture with them. *Curaçao* derives its flavour from oranges, *crême de menthe* from peppermint, *kirsch* from cherries, *absinthe* from wormwood, *kümmel* from cumin or caraway seed, and *maraschino* from marasca cherries.

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Wingate, Sir Reginald, British soldier, born in Renfrewshire 1861. He joined the Royal Artillery in 1880, and in 1883 was posted to the Egyptian army, beginning a long connection with Egyptian affairs, during which he became Sirdar and Governor-General of the Sudan (1899–1916), and High Commissioner in Egypt (1917–9). He conquered Darfur (1916), and was General Officer Commanding in the Hedjaz from 1916 until 1919. He retired in 1922. Among his publications the chief one is the English edition of Slatin Pasha's *Fire and Sword in the Sudan* (1896).

Winnipeg, a lake of Canada, mainly in Manitoba; length, about 250 miles; greatest breadth, 70 miles. The Winnipeg, Red River, and Saskatchewan are its tributaries, and it receives the surplus waters of Lakes Winnipegosis and Manitoba, while its own surplus waters are carried by the Nelson into Hudson Bay. The River Winnipeg rises in the Lake of the Woods; length, 250 miles, interrupted by falls.

Winnipeg, the third city of Canada, capital of the province of Manitoba, at the confluence of the Red River and Assiniboine, 40 miles south by west of Lake Winnipeg. In 1870 it was only a village; its growth has been due in great measure to its central position on the continent, forming a gateway to the west and north-west, and in a region whose agricultural and other resources have been rapidly developed, so that by help of railways and rivers it has become a great commercial and financial centre, with fourteen main and other railway lines radiating from it. It is a great grain market, and has a large trade in cattle, flour, cheese, furs, &c., while manufacturing industries are progressive. The provincial university, founded in 1877, is at Winnipeg. Pop. (1921), 178,364; Greater Winnipeg, 276,000.

Winnipegosis, a lake of Manitoba, Canada, drained circuitously to Lake Manitoba, through Waterhen Lake and Waterhen River. It is 828 feet altitude, from 120 to 130 miles long, and has an area of 1936 sq. miles (estimated by some at 2080 sq. miles). The coast-line measures approximately 600 miles.

Winona, a city of Minnesota, United States, the county seat of Winona county, a river-port on the Mississippi; served by the Chicago Great Western and other railways. It is an educational centre, and has extensive manufactures. Founded in 1853, it became a city in 1857. Pop. 19,143.

Winter, the season of greatest cold. Etymologically the term signifies the season of ‘ wind ’, just as summer is the season of ‘ sun ’. The day is shortest at 22nd Dec., when the sun is 23½° south of the equator, and is above the horizon for only 7 hours 45 minutes at London, and 6 hours 53 minutes at Edinburgh and Glasgow. The warmest weather occurs upon an average about a month after the longest day, and similarly the coldest occurs upon an average about a month after the shortest day. For the northern hemisphere, therefore, meteorologists adopt as a convenient arrangement the allocation to winter of the three calendar months December, January, and February, being the three coldest months of the year. In southerly latitudes, of course, winter comprises our summer months of June, July, and August. According to what is known as the astronomical division of the seasons, winter extends from the winter solstice on 22nd Dec. to the vernal equinox on 21st March.

Winter Aconite, a small herb, *Cammarum* (*Eranthis*) *hyemale*, nat. ord. Ranunculaceæ, producing bright yellow flowers very early in spring.

Winter-cress, the common name of two British cruciferous plants of the genus Barbarea. *B. vulgāris*, called also *yellow rocket*, grows on the banks of ditches and rivers, and about hedges and walls. It is bitter and sharp to the taste, and is sometimes used as a salad.

Winter-green, a name of several plants, one of them being the partridge-berry (q.v.), which yields *oil of winter-green*, otherwise called *oil of gaultheria*. This oil consists almost entirely of methyl salicylate, and is valuable as an application in rheumatics. The name is also given to a genus of perennial plants (Pyrŏla), order Pyrolaceæ, having short stems, broad evergreen leaves, and usually racemose white or pink flowers. *P. rotundifolia* possesses astringent properties, and was formerly used in medicine.

Winter-moth, a moth (*Cheimatobia brumāta*), the larvæ of which are exceedingly injurious to apple, pear, cherry, and plum trees. The moths appear in their perfect state in the beginning of winter. Pupation takes place in the ground, and the wingless females can be prevented from climbing fruit-trees by tarring or grease-banding their trunks.

Winter's-bark (*Drimys Winteri*), a plant of the nat. ord. Magnoliaceæ, a native of South America. It is an evergreen shrub, the bark of which has an agreeable pungent aromatic taste, and tonic properties.

Winterthur, a town of Switzerland, canton of Zürich, on the Eulach; an important railway junction. It carries on cotton-spinning, silk-weaving, iron-foundries, machine-making, &c. Pop. (1920), 49,967.

Wire, a form into which a ductile metal may be drawn by passing it through a die. The property of ductility (q.v.) is one which varies greatly from metal to metal. An important example is copper of the high quality used for electrical conductors. To produce small sizes the heavier sections are pulled through a series of dies of decreasing aperture until the required diameter is attained. In these dies diamonds, either natural stones or chips, are used as the reducing medium if the metal is copper. Steel dies are used in the manufacture of steel wires, but a better product, both as regards approach to true circular form and closeness to the required dimensions, is obtained with diamonds. The life of the stones is much shorter on steel than on copper. Wires are specified to standard gauges, of which the Standard, the Birmingham, the American, and the Whitworth are the most important. For the dimensions of any particular number of wire, any engineers' pocket-book may be consulted.

Wire, Bowden. The Bowden system of transmission of force consists of a practically inextensible wire cable threaded through a practically incompressible flexible tube, the tube being formed by a closely coiled spiral steel wire. The mechanism is complete in itself, and only requires to have one member fixed at both ends, and the other member attached to the operating lever at one end and the object to be moved at the other end. The steel cable may be anchored, and the flexible tube then used as a medium for pushing.

Wireless Telegraphy and Telephony. Wireless telegraphy is the art of signalling through space by means of *electro-magnetic waves* or *displacement currents* in the ether, the to-and-fro alternations of which, or the *frequency*, for commercial purposes being comprised within the present practical limits of 3×10^8 per second and 10^4 per second, corresponding to wavelengths in free space of 1 metre and 30,000 metres. The important part played by the non-conducting medium in electrical actions was demonstrated by Faraday in 1837, when he showed that the charge given to an electric condenser does not reside in the conductors, the metal plates, but in the so-called insulator, the air or glass between the plates. He represented the charge by 'lines of force' stretched through the non-conductor with their ends fixed to the conductors; and when the insulating medium is considered in its relation to the forces acting in this way through it, he proposed 'to use the word *dielectric* to express that substance'. The fact that a steel needle was sometimes magnetized in one direction and sometimes in the opposite direction by the discharge current of a condenser, led Joseph Henry, in 1842, to the conclusion that under certain conditions the condenser discharge is oscillatory; and in 1853 William Thomson (Lord Kelvin) worked out the mathematical theory, and showed that if the discharge takes place through a circuit of low electrical resistance, the current does not die out at once but first charges the condenser in the opposite sense, then again in the same sense, the storage of energy being transferred from the condenser to the magnetic field, then back again to the condenser, and so on, the amplitude of the current gradually growing less, and the oscillation finally dying out when all the energy in the circuit has been transformed into heat.

If E is the total energy in the circuit—the dissipation of energy being neglected—C the capacity, L the inductance, Q and *i* the charge and current respectively at any instant, then $E = \frac{1}{2}Q^2/C + \frac{1}{2}Li^2$. If *n* is the frequency of the oscillations per second, T the periodic time of the oscillations in seconds, L the inductance of the circuit in henrys, C the capacity in farads, then if the resistance of the circuit can be neglected, $T = 2\pi\sqrt{LC}$ and $n = 1/(2\pi\sqrt{LC})$.

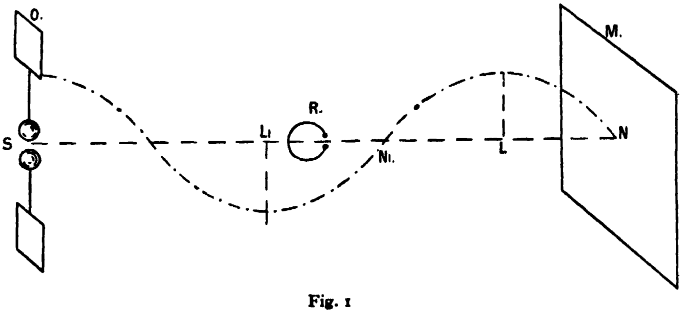


Fig. 1

Feddersen, in 1857, was the first to obtain experimental confirmation of the oscillatory nature of the condenser discharge. When the image of the spark was spread out by means of a rotating mirror, it was seen to consist of a number of sparks following each other at regular intervals.

Clerk Maxwell's epoch-making paper, *A Dynamical Theory of the Electro-magnetic Field,* was read in 1864. Maxwell's views (see *Ether*; *Wave Theory of Light*) partook of the nature of highly interesting speculations until 1888, when convincing evidence of their truth was provided by the brilliant research work of Heinrich Hertz. Hertz endeavoured to produce in a condenser circuit electric oscillations of extremely high frequency, and he therefore used a condenser of very small capacity and connections of very small inductance. Employing an air dielectric, he separated the two conductors as far apart as their connections would allow. The arrangement he called his large oscillator consisted of two spheres of zinc 30 cm. in diameter at the extremities of two metal rods placed in line, with their inside ends terminating in brass knobs of 3 cm. diameter, between which a spark discharge was made to take place. The two rods and spark gap measured 150 cm. over all, and the calculated oscillation frequency of the spark was 5×10^7 per second. The electrostatic field of this *dumb-bell* oscillator bulged well into the surrounding space, and Hertz had thus discovered the best form of condenser for producing electromagnetic waves, because during the periodic oscillations of the charge a maximum proportion of energy permanently leaves such a condenser circuit as waves of displacement current in the surrounding dielectric. For detecting these waves Hertz employed a *resonator,* a loop of wire broken by a small adjustable air gap. This device had the same natural period of oscillation as the condenser circuit, and when placed with its plane parallel to the axis of the oscillator and its air gap parallel to the oscillator spark gap, it indicated electromagnetic induction by the passage of a minute spark *across* the air gap. Oliver Lodge had already produced stationary waves on wires by reflection and interference, and Hertz adopted the same principle to produce in the air dielectric electromagnetic waves which were stationary and could therefore be examined.

In fig. 1 the spark of the oscillator O is indicated at S, a sheet of zinc 2 metres × 4 metres at M was used as a reflector, and the resonator R was moved along the axis SN to determine the character of the radiation sent off from O. When the distance SN is suitable, the resonator will show no spark at N, a maximum spark at L, no spark again at N_1, and a second maximum at L_1, as indicated by the dotted curve. The two points N and N_1, being positions where there is no electric force, must be nodal positions of the stationary electro-magnetic waves, and the distance between them must be half a wave-length. The points L and L_1 are called *loops of electric force,* and the distance between them also is half a wave-length.

For the oscillator in question the radiated waves had a length of 6 metres. In other experiments employing his small or rectilinear oscillator—two short rods fitted with spark balls, each rod and ball being 13 cm. over all—he used a frequency of 5×10^8 and a wave-length of 60 cm. Hertz showed by experiment that electromagnetic waves as thus produced could be reflected, refracted, and polarized, behaving in these and other ways very much like waves of light (see *Hertz*; *Hertzian Waves*). Fig. 2 shows the *lines of electric induction* of four half waves leaving the Hertz rectilinear oscillator. They are closed loops of electric strain; the wave fronts expand as they move outwards, but the width of the loops in the same dielectric remains the same.

Blondlot in 1893, Trowbridge and Duane in 1895, and Saunders in 1896, by various experiments, particularly by photographing the spark images of a train of oscillations obtained in a revolving mirror and measuring the interval between them, finally removed all doubt that electro-magnetic waves have the same velocity as light waves, namely 3×10^{10} cm. per second. If the capacity C of the transmitter circuit is measured in *microfarads*, and the inductance L in *microhenrys*, then the wave-length of the radiation in air or free space, measured in *metres*, will be given by the formula $\lambda = 1885\sqrt{LC}$.

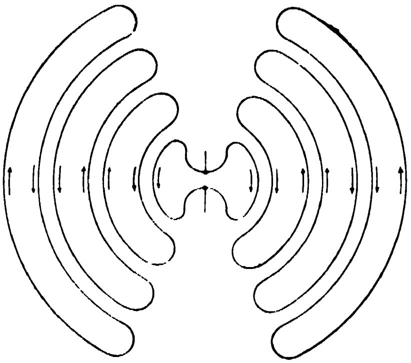


Fig. 2

The spark indicator of the Hertz resonator required an induced E.M.F. of several volts, and was therefore a very insensitive form of detector. Branly, in 1892, employed a 'coherer' for this purpose, a glass tube containing loosely-packed, finely-divided metal filings, which by its large change of conductivity on the application of a small E.M.F. made it possible to detect the presence of feeble electro-magnetic waves or waves which had become feeble by expansion in travelling to a distance. Wireless telegraphy as an art practically dates from the employment of this instrument. The first practical working circuit was demonstrated by Guglielmo Marconi in 1895, and in 1896 he improved the transmitter by elevating the conductor, a sheet of zinc connected to one side of a spark ball oscillator, and connecting the other side to ground, a similar arrangement of elevated plate and ground wire being connected to a coherer of special design at the receiving end. But the great advantage of height was demonstrated in the following year when, discarding the capacity area, a single wire, supported sometimes by balloon, sometimes by kite, was used by Marconi for signalling up to a distance of 34 miles, a ground connection to the oscillator also being employed. The vertical wire has been given the name *aerial* or *antenna*.

The very important principles of the reservoir circuit and *tuning* were introduced by Marconi in 1900. Instead of the generator feeding energy direct into the aerial, it was made to excite a closed oscillating circuit of low resistance, which lost very little of its energy by radiation; and this circuit was inductively coupled to the aerial system, which, being of the open type, was a good radiator. The energy lost by the aerial is replaced by energy taken up inductively from the closed circuit, and so more energy can be radiated. The closed and the open circuit were adjusted to be in resonance. Similar coupled circuits in resonance were also introduced in the receiver, and the receiver was adjusted to be in resonance or *in tune* with the transmitter.

The term *coupling* designates the degree to which one circuit is electro-magnetically linked with another circuit.

The effect of coupling k on two circuits having the same natural wave-length λ_0 is to produce in both of them two new wave-lengths λ_1 and λ_2 such that $\lambda_1^2 = \lambda_0^2(1 + k)$, and $\lambda_2^2 = \lambda_0^2(1-k)$, so that $k = (\lambda_1^2 - \lambda_2^2)/(\lambda_1^2 + \lambda_2^2)$; and $100k$ is called the percentage coupling.

In Dec., 1901, Marconi received the first signals across the Atlantic at St. John's, Newfoundland, from Poldhu, Cornwall, a distance of 1800 miles, and thus proved that electro-magnetic waves are able to bend round the curvature of the earth. The transmitting power was 12 kilowatts; wave-length, 400 metres; height of aerial, 200 feet. At St. John's he employed a kite-flown aerial, a tuned receiver circuit, and a coherer developed by the Italian navy, consisting of a blob of mercury between plugs of carbon and iron mounted in a glass tube. The magnetic detector of Marconi, which depends on the effect of high-frequency currents on the magnetic state of a moving band of iron wire, displaced the coherer in 1902. In this instrument the signals are received on a telephone. The telephone itself cannot respond to changes as rapid as those produced by high-frequency currents, but if the high-frequency effects are split up into groups of an audible frequency, the telephone will respond to the group frequency.

Other improved forms of detector followed. In the 'barretter' of Fessenden (1902) the change in resistance of a fine wire due to the passage of the high-frequency current is made to alter the current in a telephone circuit so that the telephone responds. In 1906 H. C. Dunwoody discovered the carborundum-steel combination, the first and unquestionably the most reliable although not the most sensitive of the numerous *crystal detector* class, which includes tellurium-aluminium and tellurium-silicon, used by L. W. Austin in 1906, and silicon, zincite, chalcopyrites, bornite, and molybdenite, patented by G. W. Pickard at various dates from 1906.

If an alternating E.M.F. is applied to a crystal detector, the positive half will produce a much larger current than the negative half, or vice versa, and the integration of the effect will have the effect of *an interrupted direct current.* The crystal therefore acts as a *rectifier.* The telephone cannot respond to high-frequency impulses, but it can respond to groups of such impulses rectified in this manner if the group frequency is within the audible limits. The transmission of signals is therefore arranged accordingly. In practice the signal E.M.F. is extremely small, and better results are therefore obtained by applying a constant E.M.F. to the crystal to cause it to work at that position on the characteristic at which the greatest *rate-of-change* of current with applied E.M.F. takes place, the actual position always being found by trial.

Direction Finding: Range.—In the 'frame aerial' method of direction finding the receiving aerial consists of two vertical parts which can be rotated. The current in the receiver is a maximum when the direction of the incoming wave lies in the plane of the frame. In a modified system two aerials are fixed at right angles, and a search coil rotates. For the benefit of shipping, short-wave directional beam stations have been set up at Inchkeith and South Foreland. The directive element is got by means of a rotating aerial, the signal from which varies with the position of the aerial. The signal which a ship picks up most strongly indicates the bearing of the sending station. Problems relating to the range of signals have been much studied. Some of the facts are very curious. The wave-length, the power used, and the time of day are the important factors. Waves of about 1000 metres long travel much better by night than by day. Waves of 30 metres can be detected up to 50 miles, disappear from 50 to 500 miles, and reappear from 500 up to 1500 miles. Extreme ranges are at times attained with very elementary apparatus. *Wave-length: Beam Wireless.*—For many years short waves (say 5 to 100 metres) were regarded as impracticable for long-distance work on account of their rapid absorption. The wave-lengths used in commercial stations designed before 1926 vary from 8000 to 30,000 metres. The great Post Office station at Rugby, for example, is capable of dealing with a continuous output to the aerial of 500 kilowatts at a wave-length of 18,000 metres, and has a world-wide range over the twenty-four hours of the day. The aerial is supported by eight towers, each 820 feet high. Many similar stations are in operation on the Continent and in America. The cost of these large stations is about £500,000. With a view to evolving a cheaper system, Marconi and C. S. Franklin began about 1916 to experiment with short waves, and ultimately demonstrated their complete practicability. A row of aerials, backed by a series of reflectors, is an essential feature of the system they eventually devised. In 1924 the Marconi Company entered into an agreement with the British Post Office for the supply of stations on this short-wave 'beam' system capable of communicating to and from Canada, South Africa, India, and Australia. The stations were to be worked through land lines from the Central Telegraph Office in London. In Oct., 1926, the station for corresponding with Canada was certified by the engineer-in-chief of the Post Office to have passed all the stipulated tests. *The Heaviside Layer.*—Wireless waves do not spread out in straight lines into space, but travel round the earth's surface. Mathematical theories have been given, but the signals actually received at great distances are some thousands of times stronger than theory predicts. The generally accepted explanation is that the effect is due to ionization (q.v.), as a result of which the upper atmosphere becomes practically a conducting shell concentric with the earth's surface and capable of reflecting the waves. This shell is usually called the Heaviside layer. It is conjectured that the ionization may be caused by an actual stream of solar electrons, which may possibly have some relation to sunspots.

The High-frequency Generator.—In order to charge his oscillator Hertz employed a Ruhmkorff induction coil. This machine was used in the first commercial installation to charge the aerial-earth system directly, and this method of transmission was called 'plain aerial'. The demand for greater range of transmission led to the use of alternators and transformers, and the fixed electrode discharger was replaced by the rotary discharger, which, besides increasing the power which could be dealt with, effected an immense improvement in the regularity of the spark, so that the sending station could be recognized by its note,

In the Marconi tuned transmitter circuits the coupling must be weak, and careful tuning is relied on to bring the aerial oscillation up to its maximum by resonance. Max Wien pointed out in 1906 that tight coupling can be employed, and therefore much more energy can be transferred to the aerial without the production of two coupling waves if the spark in the primary circuit is rapidly quenched. The Telefunken quenched spark gap, patented in 1908, works very efficiently, and has been used on transmitting plant of considerable power. It consists of a series of copper plates with their central sparking surfaces heavily silvered and separated by mica rings. The *arc generator* dates from 1900, when W. Duddell showed that if a condenser of suitable capacity and an inductance are connected in series across the terminals of a direct-current arc (the two electrodes being solid carbon rods), then the arc gives out a note the pitch of which corresponds to the frequency of oscillation of the condenser-inductance circuit completed through the arc. In 1903 V. Poulsen described an arc circuit which allowed oscillatory currents to be generated of a very much higher frequency than was possible with the Duddell arc, and also allowed much more power to be used. His improvements consisted in the use of a hydrogenous atmosphere, a magnetic field transverse to the arc, a water-cooled copper anode, and a rotating carbon cathode. The peak of development of the spark transmitter was reached in 1912 by Marconi in his *timed-spark* method of producing continuous oscillations.

If there are several electrically similar circuits each discharging through its own rotary spark gap and producing at constant intervals trains of decaying oscillations, and if all these circuits induce into a common aerial circuit and the discharges are timed so that the induced oscillations in the aerial both overlap and are in phase, then the equivalent of a current of constant amplitude can be produced, or what is known as *continuous wave* (C.W.). Transmitters of this type of 200–300 kw. have been used, the frequency being 21,400, corresponding to a wave-length of 14,000 metres.

In 1908 R. Goldschmidt patented a high-frequency alternator which depends on the mutual induction effects of the currents in the stator and rotor windings of a machine specially built to encourage them. High-frequency alternators were made a practical success by Alexanderson in 1909. He employed a constant field, and varied the flux through the armature coils by means of an ‘inductor’ rotor which interposes a succession of narrow iron spokes between the poles in the faces of which are inset the armature windings. Each winding consists of a single zigzag wire, a succession of ‘coil elements’, and the frequency of the induced current is given by the product of the speed of the rotor and the number of inductor spokes, a spoke and slot in the rotor corresponding to a pair of north and south poles in a standard alternator. The aerial circuit must be in resonance with this alternator in order that it shall give its full output, and special high-frequency control is employed to maintain the constancy of the alternator speed. Alternators on this principle are in use of 200 kw. output at 30,000 cycles, corresponding to 10,000 metres wave-length; there are also others of smaller output and higher frequency.

Thermionic Valve.—The experiments of Elster and Geitel (1882–9), Edison (1884), J. A. Fleming (1890), and J. J. Thomson (1899) demonstrated that if a cold metal plate is mounted near an incandescent filament in an exhausted glass bulb, it takes up a charge which it receives from the negative leg of the filament, but it receives no electrification from the positive leg; also that the charge is conveyed by electrons (see *Electron*). In 1903 O. W. Richardson showed that the rate of emission of electrons from incandescent bodies could be expressed in the form $N = a\sqrt{T}e^{-b/T}$, where N is the number of electrons emitted per square centimetre of the hot body per second, T is the absolute temperature of the body, and a and b are constants. J. A. Fleming, in 1904, was the first to apply the so-called ‘Edison effect’ mentioned above to the rectification of alternating currents of any frequency, and produced what is now known as the *two-electrode valve.* The principle on which it works is illustrated in fig. 3. F is a carbon or metal filament made incandescent by current from a battery B, and P is a metal plate mounted in the same exhausted bulb as F. The oscillatory circuit LC is coupled to the aerial circuit AE, and is tuned to the same frequency as the signal current by varying the capacity of C. The trains of oscillations induced in LC

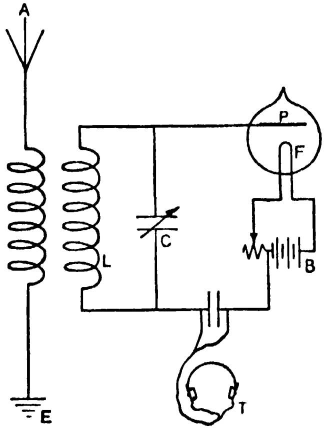


Fig. 3

corresponding to the transmitted spark signals are indicated in fig. 4 A. This results in an oscillating potential being applied to P, the positive part only of which produces a current flowing through the valve from F to P, having the rectified form shown in fig. 4 B. A condenser is shunted across the telephone T to provide a path of low impedance for these oscillations, and the current through the telephone assumes the form shown in fig. 4 C as a result of the mean value of the varying potential difference between its two terminals, so that there are as many impulses applied to the diaphragm as there are trains of oscillations, and the note produced will have a corresponding audible frequency which can be cut up into shorts and longs for the transmission of code messages.

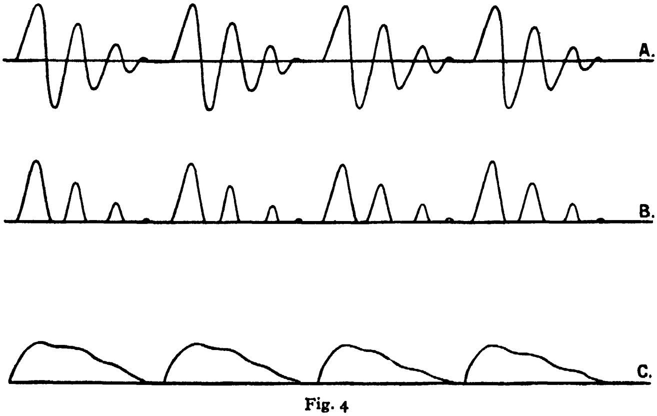


Fig. 4

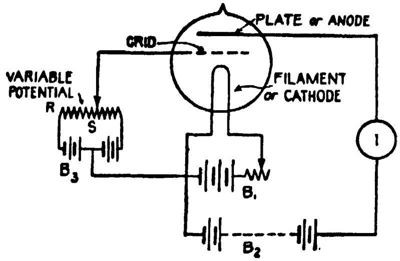


Fig. 5

Lee de Forest, in 1907, described the first *three-electrode valve* (fig. 5). If for a given filament current, and therefore a given filament temperature, a fixed positive potential is applied to the plate—which is also called the *anode*, as only positive potentials are applied to it—then a steady unvarying current will flow through the plate circuit. The third electrode inserted by Lee de Forest is employed to control this plate current, and as it is usually inserted between the filament and the plate, and the plate current has to flow past it or transversely through it, it is given an open form like a spiral or wire mesh, and is called the *grid*. A negative potential applied to the grid will oppose the flow of the negatively charged electrons to the plate, and so will reduce the plate current; and a positive potential applied to the grid will encourage the flow to the plate. Thus a change in potential of the grid, which may be brought about by the application of a negligible amount of electrostatic energy, may control the discharge of the energy stored in the comparatively large reservoir provided by the plate battery B_2. If the potential changes caused by a very weak signal are applied to the grid, a very much amplified signal can be obtained in the plate circuit; and further, if the valve circuits are properly adjusted, all the characteristics of the signal are amplified in the same proportion, so that all irregularities of wave-form are reproduced without distortion. The *grid-plate characteristic* of a three-electrode valve, as obtained with the circuit of fig. 5, showing the change of plate current with change of grid potential for fixed values of filament current and plate voltage, is given in fig. 6. For comparison the *plate characteristic* of the same valve is also given in the figure, as it shows the relation between the plate current and the plate voltage when two electrodes only are used, viz. the filament and the plate, the grid being joined to the negative leg of the filament.

For *rectification* there must be an asymmetrical change of plate current for a symmetrical change of plate voltage applied to the two-electrode valve, or of the grid voltage applied to the three-electrode valve; and this operation takes place, therefore, when the valve is adjusted to work at the top or bottom bend of its characteristic. An adjustment on the straight inclined part of the curve is of no practical value with the two-electrode valve, but the three-electrode valve must be adjusted to work at this position on the grid-plate characteristic when it is required to amplify without distortion, the drop in plate current due to the application of a negative charge to the grid being then equal to the rise in plate current when an equal positive charge is applied to the grid. *High-frequency amplification* takes place when the signal current is amplified before being rectified; *low-frequency amplification* takes place after rectification.

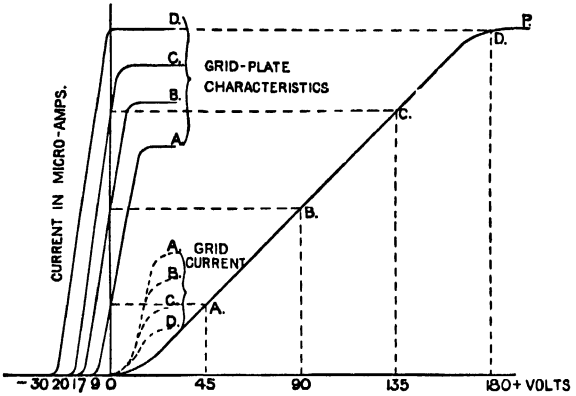


Fig. 6

Retroaction, a very important property of a valve circuit, introduced by C. S. Franklin in 1918, takes place when the plate circuit is made to transfer part of its energy to the grid circuit, with the object of increasing the amplifying effect in the plate circuit. In fig. 7 a coupling between the two circuits is shown at L_pL_g. When the plate circuit is closed by the switch K, a current flows from the filament F to the plate P and through the coil L_p. The growth of the magnetic field in L_p cuts L_g and generates in it an opposing E.M.F. which is immediately applied to the grid G and checks the flow of current from the filament to the plate. The fall in the plate current, and in the magnetic field produced by the coil L_p, generates an E.M.F. in L_g which tends to maintain the magnetic field and therefore assists the passage of the current from F to P, and so once more the plate current increases, and the process is repeated, the periodicity being determined in this case by the time constant of the plate circuit as given by the inductances L and L_p and the condenser C. In the circuit adjustment just mentioned the E.M.F. induced on the grid was in the first instance negative and in the second instance positive. By rotating one of the two coupling coils, or by reversing the connections, it is clear that retroaction can be used to reduce instead of to increase the amplification in the plate circuit; in fact a useful range of amplification adjustment can be obtained with a *reaction coil*, which gives an adjustable coupling.

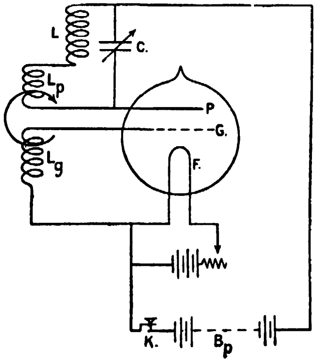


Fig. 7

The Valve Oscillator Generator.—It is only one step further to find by trial a reaction adjustment which will keep the high frequency circuit L_pLK in permanent oscillation, the energy fed into it every cycle from the battery B_p being just sufficient to compensate for the energy which leaves the circuit during the same period, the circuit itself arranging the correct timing of the feed from the battery in the manner already described. A high-frequency transmitter consisting of a valve oscillator coupled to an aerial is shown in fig. 8. In this case the aerial circuit

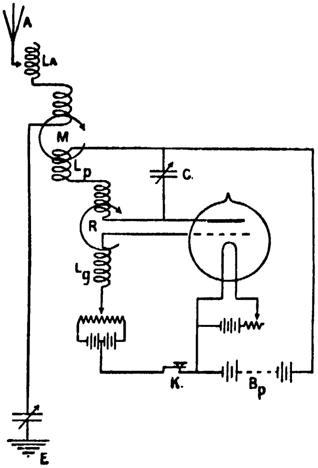


Fig. 8

is coupled at M to the tuned plate circuit whence it draws its power, the retroaction coupling being at R. The Marconi Company, which has pioneered high-power valve transmission, has a 200-kw. installation at Carnarvon. In 1918 text messages were received from this transmitter at Sydney, 12,000 miles away.

Reception of Continuous-wave Signals. — To produce a sound during the complete duration of the signal, the continuous wave must either be broken up into groups and so given a group frequency, which method is known as *tonic train*; or, preferably, beats must be produced in the continuous wave of a frequency to which the telephone and the ear can respond. The *beat generator* is simply a valve oscillation generator of very low power which is coupled to the receiver aerial circuit, and induces a current in it having a frequency which is slightly mistuned to that of the incoming signal current so as to produce the required beat. The beat current is rectified, and is then in a suitable form to produce an audible note in the telephone.

Wireless Telephony.—The same main transmitting circuit is used as for continuous-wave telegraphy to produce 'the carrier wave', or high-frequency electro-magnetic radiation, on which is superposed the low-frequency modulation corresponding to the speech current waveform produced by the voice when speaking into the microphone. The carrier wave may have any value within the range of commercial wavelengths, usually between 300 metres and 3000 metres, corresponding to frequencies of 10^6 and 10^5. The speech currents contain a mixture of frequencies, the minimum being about 20 per second, and the maximum about 40,000 per second.

A carbon granule microphone is an instrument which consists of two carbon plates, one fixed to the solid back of the instrument, the other mounted on a mica diaphragm and free to vibrate with it. Between the two carbon plates are loosely-packed granules of carbon. The electrical resistance of this arrangement is very sensitive to changes of pressure, and an electric current which is led in through one carbon plate and out through the other varies correspondingly in strength as the voice produces vibrations of different frequency and amplitude in the mica diaphragm. It is, however, essentially a low-current instrument, and on this account can only be inserted direct in the transmitting aerial when the power of the transmitter is very small.

In the method known as *grid control*, the variations of the direct current through the microphone create corresponding E.M.F.'s in the secondary of a transformer winding, whence they are applied directly to the grid of the oscillating valve. A stronger modulation is obtained by means of 'choke control' (fig. 9). Instead of modulating the grid potential of the oscillating valve O, it is the plate potential which is now altered. This requires an additional valve X, having a large iron core choke L_x in its plate circuit.

Broadcasting is the name given to the general dissemination of news and concerts by wireless telephony for popular amusement.

Effective transmission necessitates the very careful elimination of all sounds other than those which it is required to transmit, as sounds which in many cases could be ignored in commercial speech telephony would seriously impair the transmission of musical items. Many problems centre round the microphone: it must not favour the high notes more than the low; an accurate balance of sound must be maintained between a singer and his accompaniment, possibly more than one microphone being necessary; and there must be no echo or note resonance. Effective reception necessitates a greater intensity and better quality of speech and more freedom from local and outside interference effects than is essential for commercial speech telephony, although the receiving aerial at its best is not more than 25 feet to 30 feet in height, and may often be of a most inefficient indoor type, small frames taking up the least space possible being frequently employed. Also, instead of using telephones it is often necessary to project the speech into a room or hall. To meet these conditions very sharp high-frequency tuning is essential; a simple crystal or single valve receiver may be sufficient for the telephone.

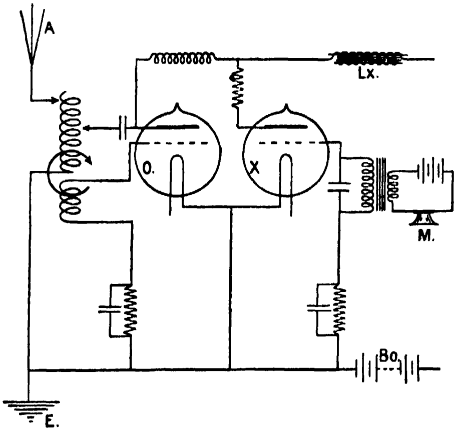
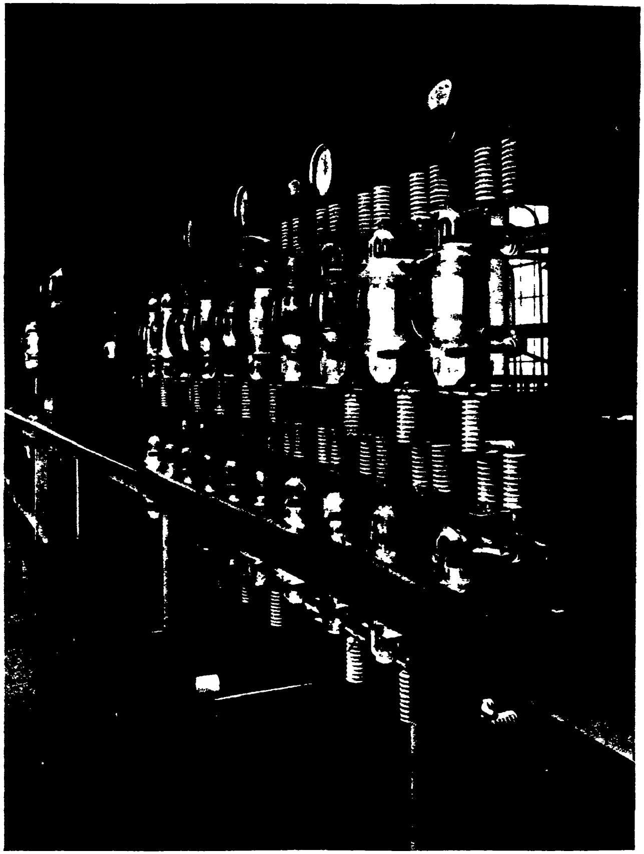


Fig. 9

Broadcasting in Britain may be said to date from 15th June, 1920, when, by transmission

WIRELESS

Wireless Cabin, R.M.S. *Berengaria*



Interior of the Ongar Power Station

from Chelmsford, Essex, songs by Dame Nellie Melba were heard over a very wide radius, including St. John's, Newfoundland, 2673 miles away. Programmes of speech and music from the stations of amateurs having transmitting licences soon became common. After negotiations between manufacturers and the Post Office, the British Broadcasting Company was formed in Dec., 1922, and, being granted certain exclusive privileges, gradually established regular systems of concerts and lectures from many stations. It was made compulsory for possessors of receiving sets to obtain a licence from the Post Office.—Bibliography: H. M. Dowsett, *Wireless Telephony and Broadcasting*; J. A. Fleming, *Principles of Electric Wave Telegraphy and Telephony.*

Wireworm, a name given by farmers to the subterranean larvæ or grubs of click-beetles or skipjacks, family Elateridæ. Common species are *Agriotes lineatus* and *Athous hæmorrhoidalis.* They live for three to five years in the larva state, during which time they are very destructive to vegetation.

Wirksworth, a market town of Derbyshire, England. Pop. (1921), 3615.

Wisbech, a town and port of Cambridgeshire, England, in the Isle of Ely, on the Nene. Exports are mainly of agricultural produce, and imports are of coal and timber. Pop. (1921), 11,316.

Wisby, or **Visby**, a seaport-city of Sweden, on the west coast of the Island of Gottland, at one time an important town in the Hanseatic League. Pop. 9960.—*The Laws of Wisby* are a collection of mercantile customs and regulations, dating from the last years of the thirteenth century. They were made the basis of the ordinances of the Hanseatic League. See *Insurance* (section *Accident or Casualty Insurance*).

Wiscon'sin, a river in the United States, rises on the northern border of Wisconsin state, runs southward, becomes navigable at Portage City, and enters the Mississippi 4 miles below Prairie-du-Chien after a course of nearly 600 miles.

Wisconsin, an East North Central state of the United States. It has a coast-line on Lake Michigan in the east, and a shorter one on Lake Superior in the north-west, and is generally a rolling plain, the highest points of the state being in the Penokee Range, and in Rib Hill (1940 feet) in the north. Wisconsin drains mainly to the Mississippi, the chief rivers being the St. Croix (forming western boundary for over 130 miles), Chippewa, Black, and Wisconsin (600 miles long); the Fox (250 miles) is the chief river flowing to Lake Michigan. The state is subject to tornadoes. The mean annual temperature is 44° F. (February, 15°; July, 70° F.), and the rainfall 32 inches. Madison is the state capital; other cities are: Milwaukee (the largest), Racine, Kenosha (pop. 40,500), Superior (39,700), Oshkosh, Green Bay, Sheboygan (31,000), and La Crosse. In 1921 there were 7553 miles of railways. Agriculture is the chief occupation, maize, wheat and other cereals, tobacco, sugar-beet, &c., being produced. Orchard-fruits are raised, and dairying, including the production of cheese, butter, and condensed milk, is very important. Sheep-rearing is progressive. Zinc is the chief mineral, followed by iron (hæmatite). There are several mineral springs with a large output. The Lake fisheries are prolific. Manufactures are mainly connected with the iron and steel industries. About 17·5 per cent of the population is classed as foreign-born, and about 33 per cent of this number is German; Norwegians, Swedes, Canadians, Italians, and English following in order. There are 10,404 Indians (1921) occupying reservations of 404 sq. miles. Elementary education is compulsory between the ages of seven and fourteen years, with a further period of continuation- or industrial-school training up to seventeen years of age. The State University is at Madison. State area, 56,066 sq. miles (810 sq. miles being water), exclusive of rights over 2400 sq. miles on Lake Superior and 7500 sq. miles on Lake Michigan. Pop. (1920), 2,632,067 (including 5201 negroes).

Wisconsin was admitted to the Union in 1848. The Legislature is bicameral, comprising a Senate (33 members, elected for four years, a proportion seeking re-election biennially) and an Assembly (100 members, for two years). There are 69 counties. Two Senators and 11 Representatives are sent to Congress.

Wiseman, Nicholas, Cardinal, English Roman Catholic prelate, born 1802, died 1865. He joined the English College then newly formed (1818) at Rome; became professor of Oriental languages and (1828) rector of the English College; returned to England (1835), and was appointed successively rector of Ushaw, vicar apostolic of the central district of England, and Roman Catholic Archbishop of Westminster (1850). He was the author of *Lectures on the Connection between Science and Revealed Religion* and *Recollections of the Last Four Popes.*

Wishart, George, Scottish reformer and martyr, was born in Kincardineshire early in the sixteenth century, died in 1546. Educated at Aberdeen, he travelled in France and Germany, where he accepted the Reformed doctrines; returned to Scotland and began to teach, but was prosecuted for heresy. In 1538 he fled to England, and remained in Cambridge for six years; returned to Scotland in 1543, and preached in the chief towns, for which offence, at the order of Cardinal Beaton, he was arrested in the house of Cockburn of Ormiston, tried by a clerical assembly in St. Andrews, and burned at the stake there.—Cf. C. Rogers, *Life of George Wishart, the Scottish Martyr*.

Wish'aw, formerly a police burgh of Lanarkshire, Scotland, now united with Motherwell (q.v.). It has several large coal-mines, iron-, steel-, and nail-works, fireclay brick-works, railway-wagon works, a distillery, &c.

Wismar, a seaport-town of Mecklenburg-Schwerin, on the Bay of Wismar, an arm of the Baltic Sea; served by rail to Rostock and Karow; the seaward terminus of the railway to Ludwigslust (pop. 6500). Machinery, paper, cement, asphalt, and sugar are made, and brewing and iron-founding are carried on. There is a large shipping trade in wood, coal, grain, paper, wine, stone, sugar, &c. Wendorf, a noted sea-bathing resort, lies about a mile north-west. Acquiring the rights of a town in 1229, Wismar received extended privileges in 1266, fell to Mecklenburg in 1301, and was an important Hansa town. From 1648 until 1803 it was a Swedish possession, and was not definitively incorporated in Mecklenburg-Schwerin until 1897. Pop. 25,200.

Wissembourg (Ger. *Weissenburg*), a frontier town of France, in the department of Bas Rhin; served by rail to Strasbourg, Lauterbourg, and Mainz. Matches, leather, paper, dye-stuffs, and beer are made, and there is a large lithographic establishment. In the first engagement of the Franco-German War, fought at Wissembourg (4th Aug., 1870), the French were defeated. Pop. 12,000.

Wista'ria, a genus of plants, nat ord. Leguminosæ. The species are deciduous, twining, and climbing shrubs, natives of China and North America. Several (as *Wistaria chinensis*) have been introduced into England, and, when in flower, they form some of the handsomest ornaments of the garden. *W. frutescens* is a species belonging to the United States.

Witchcraft, a term applied to the supernatural power which persons were formerly supposed to obtain by entering into compact with evil spirits. The belief in witchcraft existed among all primitive nations, but it is also to be found in Babylonia and Egypt, and frequent references to witches are made in Holy Scripture. With the advent of Christianity the conception of witchcraft underwent a change. Among the early Christians the doctrine of the active agency of the spirit of evil in human affairs became more fully developed than it had previously been. Satan was supposed to be in league with the vanquished gods of paganism, and witches were believed to have a compact with the dethroned gods and especially with Satan. Like a nightmare the belief in witchcraft oppressed mankind from the thirteenth to the seventeenth century. The Roman Catholic Church and the Inquisition identified witchcraft with heresy, and witches were punished as idolaters and servants of Satan. By means of torture supposed witches were made to confess that they could ride through the air on brooms, and that they visited mountain tops and wild heaths where they held religious festivals, or Sabbaths, and celebrated the Black Mass. In 1484 Innocent VIII issued a Bull, ordering the severe punishment of witches, and soon after the form of proceeding was laid down in the famous *Malleus Maleficarum* (Hammer of Witches). No fewer than 100,000 victims must have suffered in Germany, and altogether over 300,000 suffered death in Europe. The last trial for witchcraft in England took place in 1712, when Jane Wenham was convicted, and an execution took place in Scotland in 1722. Prosecution for witchcraft was abolished in the United Kingdom in 1736 by Act of Parliament. In America the last execution took place in 1692, and in France executions for witchcraft were prohibited by an edict of Louis XIV in 1670. See *Demonology*; *Magic*. — BIBLIOGRAPHY: H. C. Lea, *A History of the Inquisition of the Middle Ages*; W. E. H. Lecky, *History of the Rise and Influence of the Spirit of Rationalism in Europe*; W. Notestein, *History of English Witchcraft, 1558 to 1718*.

Witches' Broom, an abnormal development of crowded twigs resembling a broom or crow's nest, produced on various trees by the attacks of parasitic fungi. The most familiar are those on silver birch due to *Exoascus turgidus*, but species of Exobasidium and certain *rust-fungi* cause similar malformations on other plants.

Witenagemot, or **Witan** (the meeting of the wise men), the council which advised the Anglo-Saxon kings. It was composed of archbishops, bishops, abbots, members of the royal family, earls, and the small class of landowners known as King's Thegns. The Witan used to be credited with very extensive powers, including that of the election of the king, but later investigators admit that very little is known about the subject. There is no information as to how often the Witan met, and it is impossible to define its functions, and its actual authority varied with the age of the monarch and with other circumstances in the national life. The succession to the throne, from the time of Alfred to the Danish conquest under Canute, followed the rule of primogeniture, and it is probable that the 'election' by the Witan was no more than acceptance or recognition of the succession of a sovereign. The term Witenagemot disappeared after the Norman Conquest, and the institution was replaced by the *Magnum Concilium*, which developed into Parliament.

Wither, George, English poet, was born 1588, died 1667. He was educated at Magdalen College, Oxford, and in 1611 published his satires entitled *Abuses Stript and Whipt*. His more important works are: *The Shepherd's Hunting* (1615), *Britain's Remembrancer* (1627), *A Collection of Emblems*, and *Hallelujah* (1643).

Witherite, a colourless mineral formed of barium carbonate; specific gravity 4·3, nearly as high as that of barytes. It is mined at Fallowfield, in Northumberland, and is associated, like barytes, with veins of galena. It is used in chemical industries and as a rat-poison.

Witney, a market town of Oxford, England, noted for blankets. There is a bluecoat school and a free grammar-school. Pop. (1921), 3364.

Witte, Sergius Yulievitsh, Count, Russian statesman, born 1849, died 1915. He came to the fore by organizing the Russian railway-transport system during the Russo-Turkish War of 1877–8, and later (1892–3) succeeded Vishnegradski as Minister of Finance. By his vigorous and aggressive policy he almost doubled the imperial revenues, pushed forward the construction of railways, and introduced a State alcohol monopoly to stamp out drunkenness. In 1905 he went to Portsmouth (United States) as Russian delegate to the Peace Conference, and was made Count on his return. In 1903 he left the Ministry of Finance, and between 1905 and 1906 was Prime Minister. He was one of the ablest statesmen who ever assisted any Tsar.—Cf. his *Memoirs* (of which there is an English translation).

Wittenberg, a town of Prussia, in the province of Saxony, on the Elbe; the junction of the Berlin-Weissenfels and Falkenberg-Rosslau railways. It was while Luther was a professor in Wittenberg that he nailed his ninety-five theses to the door of the Schlosskirche. The university of which he was professor was united to Halle in 1817. The principal buildings are the Schlosskirche, in which both Luther and Melanchthon are buried; the Stadtkirche, where Luther and Melanchthon preached; the remains of the Augustine monastery, with Luther's apartments; and the houses of Melanchthon and Cranach. Pop. 22,000.

Wittenberge, a town and river-port of Prussia, at the disemboguing of the Stepnitz into the Elbe; an important railway junction on the Hamburg-Berlin line (via Ludwigslust), for Lüneburg, Magdeburg (via Stendal), and Perleberg (pop. 10,000). Oil and soap are made, and there is a shipping trade. Pop. 20,000.

Woad, a cruciferous plant of the genus Isătis, the *I. tinctoria*, formerly cultivated to a great extent in Britain on account of the blue dye extracted from its pulped and fermented leaves. It is now, however, nearly superseded by indigo, which gives a stronger and finer blue. The ancient Britons are said to have coloured their bodies with the dye procured from the woad plant. *Wild woad*, *weld*, or *wold* is the *Resēda Luteŏla*, a British plant, which yields a beautiful yellow dye. See *Dyer's-weed*.

Woburn, a city of Massachusetts, United States, in Middlesex county; served by the Boston & Maine Railway. Its manufactures are over 60 per cent leather, and it is the leather metropolis of New England. Settled in 1638, it became a city in 1888. Pop. (1920), 16,574.

Wodan, or **Woden**, the Anglo-Saxon form of the name of the deity called by the Norse Odin (q.v.). *Wednesday* derives its name from him, and his name is also seen in several place-names, as *Wednes*bury, &c. See *Northern Mythology*.

Woking, an urban district and town of Surrey, England, on the Wey. Brookwood and the London Necropolis (founded 1854) are near by. Pop. (1921), 26,430.

Wokingham, a municipal borough of Berkshire, England, in Windsor Forest. Pop. (1921), 4473.

Wolcot, John, British satirist, generally known by his nom-de-plume of 'Peter Pindar', was born in 1738, and died in 1819. Between 1778 and 1808 he is said to have put forth some sixty satirical productions in verse, most of them now forgotten.

Wolf, Friedrich August, German critic and scholar, born in 1759, died in 1824. His fame as a critic rests upon his *Prolegomena ad Homerum* (1795), in which he endeavours to show that the *Odyssey* and *Iliad* in their present form are not the work of one hand, but of several. Wolf's *Prolegomena ad Homerum* was not merely of importance in the history of Homeric scholarship. It introduced new ideas into criticism, and its influence was felt throughout classical and Biblical scholarship.

Wolf, a mammal belonging to the digitigrade carnivora, family Canidæ, and very closely related to the dog. The common European wolf (*Canis lupus*) is yellowish or fulvous grey; the hair is harsh and strong, the ears erect and pointed, the tail straight, or nearly so, and there is a blackish band or streak on the forelegs about the carpus. The height at the shoulder is from 27 to 29 inches. The wolf is swift of foot, crafty, and rapacious; a destructive enemy to the sheep-cote and farm-yard; it associates in packs to hunt the larger mammals, such as the deer, the elk, &c. When hard pressed with hunger, these packs have been known to attack isolated travellers, and even to enter villages and carry off children. In general, however, wolves are cowardly and stealthy. Wolves are still plentiful in some parts of Europe, as in districts of France, Spain, Italy, Germany, Turkey, and

Russia; they probably ceased to exist in England about the end of the fifteenth century; the last of them in Scotland is said to have been killed by Cameron of Lochiel in 1680, while in Ireland they are known to have existed until at least the beginning of the eighteenth century. The wolf of North America is generally considered to be the same species as the European wolf, though individuals vary much in colour and otherwise. The little prairie-wolf or coyote (*C. latrans*), abounding on the vast plains of Missouri and Mexico, is a burrowing animal. The Tasmanian wolf is a marsupial. The antarctic wolf (*C. antarcticus*) of the Falkland Islands is closely allied. Indian wolves belong to closely allied species (*C. pallipes*, *C. chanco*, and *C. laniger*). The so-called Abyssinian wolf or kaberu (*C. simensis*) is a kind of jackal.

Wolfe, Charles, author of the *Ode on the Burial of Sir John Moore*, was born in Dublin 1791, died 1823. He was educated at Trinity College, Dublin, and it was while there that the poem which has secured his fame was published in *The Newry Telegraph* (1817). He was also the author of several other poems, and his *Remains* were published at Dublin (2 vols., 1825).

Wolfe, James, British soldier, was born at Westerham, Kent, in 1727, died in 1759. He entered the army and proceeded with his regiment to the Low Countries; took part in the battles of Dettingen, Fontenoy, Falkirk, Culloden, and Laffeldt, and, after distinguished service against the French in America, he was entrusted (1759) with an army of 8000 men with which to assault Quebec. During the night this small force scaled the Heights of Abraham, which commanded the town, and in the battle which took place next day the British were victorious; but General Wolfe was wounded in the engagement, and died in the moment of victory, his opponent, Montcalm, being also mortally wounded.

Wolfenbüttel (vol′fen-büt-l), a town of Brunswick, Germany, on the Oker; a junction on the railway Jerxheim-Brunswick, for Harzburg. A library of about 300,000 volumes, besides MSS., and a statue of Lessing, who was long librarian to the duke, are notable features. Pop. 18,934.

Wolffia, a genus of water-plants, order Lemnaceæ. *W. arrhiza*, the only British species, is the smallest known flowering plant, its fronds being only $\frac{1}{20}$ inch in diameter.

Wolffian Bodies (after *Wolff*, the discoverer), in physiology, a term applied to certain bodies in the vertebrate embryo, preceding the two kidneys, whose functions they perform. As the fœtus develops they gradually disappear, their place being supplied by the true kidneys, except in fishes, in which they are permanent.

Wolfram (*wolframite* of American writers), a mineral formed of iron and manganese tungstate, the principal source of tungsten. It occurs in association with granite veins, commonly with tin ores, in dark-brown or black monoclinic crystals, often of large size. Attention is called to it by its high specific gravity, 7·4. The variety poor in manganese and rich in iron is called *ferberite*. *Hübnerite* is almost pure manganese tungstate. Both these minerals are isomorphous with wolfram. The modern demand for tungsten has given importance to the wolfram of the Cornish tin-mines.

Wolf's-bane, a poisonous plant of the genus Aconitum (*A. Napellus*). It is a native of Alpine pastures in Switzerland, and found in a wild state in one or two parts of England. See *Aconite*.

Wollaston, William Hyde, English chemist and physicist, born in London 1776, died 1828. He was the inventor of the goniometer, an instrument for measuring the angles of crystals, and the discoverer of palladium and rhodium, and the malleability of platinum.

Wollastonite, one of the mineral group known as pyroxenes, crystallizing in the monoclinic system, typically in broad, flat, colourless crystals, whence it has been called *tabular spar*. It is a calcium metasilicate, and is common in limestones that have been altered by the intrusion of a granite magma.

Wollin (vol′in), an island and town of Prussia, at the mouth of the Oder, on the north side of the Great Haff; length, 20 miles; breadth, from 3 to 10 miles. Fishing and cattle-rearing are the chief employments. Pop. (town) 5000.

Wolseley (wụlz′li), Garnet Joseph, first Viscount, British soldier, born 1833, died 1913. He entered the army as ensign in 1852; took part in the second Burmese War (1852–3), where he was severely wounded; served with distinction in the Crimea, and was wounded at the siege of Sebastopol; engaged in the siege and capture of Lucknow during the Indian Mutiny of 1857–8; and was employed in 1860 in the Chinese War. He was dispatched to Canada in 1861, and again in 1867, having received command of the Red River expedition, which he carried to a successful issue. Three years afterwards Wolseley was appointed to the command of an expedition to punish the King of Ashanti, and after a brief campaign he entered Coomassie (Feb., 1874) and received the submission of the king. After the defeat of a British force by the Zulus in South Africa in 1879 he was dispatched as High Commissioner, but before his arrival the Zulus had been defeated at Ulundi, and little remained for him to do. His next command was in Egypt in 1882, where his forces successfully stormed the lines of Tel-el-Kebir and captured Arabi Pasha. When the Mahdi subdued the

Sudan, and held General Gordon prisoner in Khartum, Wolseley was dispatched in 1884 with a relief expedition. He concentrated his forces at Korti, and sent a column across the desert to Khartum, but the place had fallen. In 1885 he was created a viscount, from 1890 to 1895 was Commander-in-Chief in Ireland, in 1894 made field-marshal, and was Commander-in-Chief of the army from 1895 to 1900. He was awarded the Order of Merit in 1902.—Cf. *The Story of a Soldier's Life*, an autobiography.

Wolsey (wụl′zi), Thomas, English cardinal and statesman, said to have been the son of a butcher, was born at Ipswich in 1471, died in 1530. He was educated at Magdalen College, Oxford. After quitting the university he was appointed to the parish of Lymington, in Somerset. Then he became a private chaplain to the Archbishop of Canterbury, one of the governors of Calais, chaplain to Henry VII, and Dean of Lincoln. When Henry VIII became king the advancement of Wolsey was rapid. Successively he was appointed Canon of Windsor, Dean of York, Bishop of Lincoln, Archbishop of York, and his nomination as cardinal in 1515 and Pope's legate in 1518 completed his ecclesiastical dignities. In 1515 he was also appointed Lord Chancellor of the kingdom. He was twice a candidate for the Papacy, and his power in England, as also his revenues, were only equalled by those of the Crown. This rapid preferment by the king was largely the result of a remarkable series of diplomatic victories, in which Wolsey had been the means of enabling Henry to hold the balance between Francis I and the Emperor Charles V. His success in the region of politics terminated in the splendours of the Field of the Cloth of Gold (1520). In his ambitious career the cardinal had made many enemies, who were held in check so long as he retained the favour of his royal master. This favour Wolsey lost when he failed to obtain from Pope Clement a decision granting the king's divorce from Catharine of Aragon. Thenceforth the enemies of the fallen prelate harried him unmercifully. He was banished from court, stripped of his dignities, found guilty of a præmunire, and sentenced to imprisonment. Finally, after a brief respite, during which he was restored to some of his offices, and had returned to his see of York, he was arrested at Cawood Castle on a charge of high treason, and on his way to London as a prisoner he died of dysentery at Leicester Abbey. — BIBLIOGRAPHY: Mandell Creighton, *Cardinal Wolsey*; E. L. Taunton, *Cardinal Wolsey*; J. S. Brewer, *Reign of Henry VIII.*

Wolverhampton, a municipal and county borough of Staffordshire, England. It is situated in the heart of the Midland mining district, has extensive beds of coal and ironstone in its vicinity, is the largest manufacturing town in Stafford, and is known as the capital of the Black Country. The chief industries are the smelting of iron ore, and its conversion into all forms of ironware, and manufactures in brass, tin, steel, papier-mâché, galvanized iron, and chemicals. Pop. (1921), 102,373.

Wombat (*Phascolomys wombat*), a marsupial animal, a native of Australia and Tasmania. It is about 3 feet in length, and has coarse, almost bristly fur, of a general grey tint, mottled with black and white. It burrows, feeds on roots, and its flesh is said in fatness and flavour to resemble pork.

Wombwell, an urban district of Yorkshire, England, in the West Riding, on the Dove. Pop. (1921), 19,035.

Wood, Anthony, English antiquary, born at Oxford in 1632, died in 1695. He was educated at Merton College, Oxford, where he took his degrees, and spent his life in examining and sifting the records of the university. The result of his laborious researches was published as *Historia et Antiquitates Universitatis Oxoniensis* (1674), this being a Latin translation of Wood's English treatise under the authority of the university. He was also the author of *Athenæ Oxonienses* (1691–2).

Wood, Ellen, or **Price**, English novelist, better known as Mrs. Henry Wood, born at Worcester 1814, died 1887. Among her many novels may be noted *East Lynne*, which has had an enormous success both as a book and a drama; *The Channings*; *St. Martin's Eve*; *A Life's Secret*; *Roland Yorke*; *Dene Hollow*; and the *Johnny Ludlow Stories*, reprinted from the *Argosy*, of which she was long editor.

Wood, Sir Evelyn, British soldier, born in 1838, died in 1919. Educated at Marlborough College, he entered the navy in 1852, and served with distinction in the Crimean War. In 1855 he joined the army as cornet in the 13th Dragoons, and in the mutiny campaign in India in 1858 he served with the 17th Lancers, gaining the V.C. After going through the Ashanti War he was called to the Bar at the Middle Temple in 1874. For his brilliant conduct in the Zulu War of 1879 he was promoted brigadier-general and created K.C.B. He was second in command of the British forces in the short Transvaal War of 1881, and in 1884–5 he commanded the line of communication in the Nile expedition. He was made G.C.M.G. in 1882, G.C.B. in 1891, and field-marshal in 1903. His publications include: *The Crimea in 1854 and in 1894*; *Cavalry in the Waterloo Campaign*; and *From Midshipman to Field Marshal* (1906), an autobiography.

Woodbridge, a town and river-port of Suffolk, England, on the River Deben. Pop. (1921), 4600.

Wood-chuck, the popular name of a rodent mammal, a species of the marmot kind and of the squirrel family (Sciuridæ), the *Arctomys monax*, or ground-hog, common in the United States and Canada. It is of a heavy form, from 15 to 18 inches long, blackish or grizzled above and chestnut-red below. It digs out burrows in which it passes the winter in a dormant state.

Woodcock, a bird of the plover family and genus Scolŏpax, the *S. rusticula*, allied to the snipes (Gallinago). It is widely distributed, being found in all parts of Europe, the north of Asia, and as far east as Japan. It is a game-bird of Britain, where it is known chiefly as a winter visitant, but also breeds in certain districts. The bird is about 13 inches in length, the female being somewhat larger than the male. Its food is chiefly worms. Related species are native to Java and New Guinea (*S. saturata*) and the Moluccas (*S. rochusseni*). The woodcock of eastern North America (*Philohela minor*) is a smaller bird, but very similar in plumage and habits.

Woodcock

Wood-lark, a small species of lark, the *Alauda arborea*, found in Britain. Its song is more melodious than that of the skylark, but it does not consist of so great a variety of notes, nor is it so loud.

Woodpecker, a name for the climbing birds belonging to the family Picidæ, and the order Coraciiformes. The family has a very wide distribution, but is not represented in Egypt, Madagascar, and the Australian region. Woodpeckers are characterized by their long, straight, angular beak, adapted for splitting the bark of trees; by their slender tongue, with its spines at the tip curved backwards to enable them to extract insects from crevices; and by their stiff tail, which acts as a prop to support them while climbing. The noise they make in tapping the bark of a tree to discover where an insect is lodged can be heard at a considerable distance. *Dendrocopus major* and *D. minor* are European species, but the best known in Britain is *Gecinus viridis*, the green woodpecker or yaffle. The first mentioned, the great spotted woodpecker, is coloured black and white, with a scarlet crown; length, 8 to 9 inches. The great black woodpecker (*Picus martius*) ranges through the pine forests of Europe and Asia to Japan. In America the most characteristic species are *Campephilus principālis* or the ivory-billed woodpecker, *Colaptes aurātus* or gold-winged woodpecker, and the Californian woodpecker (*Melanerpes formicivŏrus*).

Woodruff, or **Woodroof**, the common name of plants of the genus Asperŭla, nat. ord. Rubiaceæ. The sweet woodruff (*A. odorāta*), with its whorled leaves and white blossom, is found plentifully in Britain in woods and shady places. The dried leaves are used to scent clothes and also to preserve them from the attacks of insects. The root of the dyer's woodruff (*A. tinctoria*) is used instead of madder.

Woods and Forests, Commission of, a British Government department under two Commissioners (one of whom is the Minister of Agriculture and Fisheries) which assumed its present form in 1912, but dates back to 1760, when George III surrendered the land revenues from Crown lands in return for a Civil List. At this time the gross revenues were about £90,000; in 1922 they were £1,848,263, of which £1,052,550 were derived from Crown lands. A large sum annually finds its way to the Imperial Exchequer from the surplus revenues of the Commission of Woods, Forests, and Land Revenues.

Woodsia, a widely distributed genus of polypodiaceous ferns. *W. hyperborea* is one of the rarest of the British ferns, being found only on Snowdon, in Wales, and one or two mountains in Scotland.

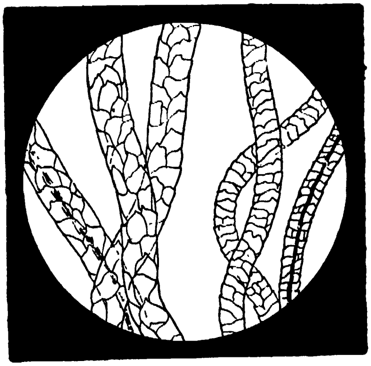
Woodstock, a town and port of entry of New Brunswick, Canada, in Carleton county; served by National and Canadian Pacific Railways. It is an agricultural centre, with an agricultural college. Carleton county possesses iron (hæmatite and limonite) deposits, some of which are near Woodstock. Pop. 4000.

Woodstock, a town of Ontario, Canada, in Oxford County, and on Thames River; served by the National and Pacific railways, and by electric railway to Ingersoll. It is the seat of Woodstock College, and is a busy manufacturing town, the centre of an agricultural district. Pop. 9700.

Wood-swallow, a name given in Australia to a genus of birds (Artămus), family Artamidæ. One species (*A. sordidus*) is remarkable for its habit of hanging suspended from dead branches in clusters resembling swarms of bees.

Wood-tar is obtained as a by-product in the destructive distillation of wood. The tar which collects below the heaps in which charcoal is burned is a thick dark-coloured liquid with a strong creosote-like smell. It contains paraffins, resins, and also phenols and phenolic ethers. Wood-tar obtained from the distillation of wood in retorts has similar properties, but is more fluid and contains a higher proportion of paraffins. The colour of the tar varies from light brown to almost black, according to the variety of wood used. On distilling the crude tar, fractions known as light and heavy tar oils are obtained. Wood-tar is used for preserving rope, wood, felt, &c., and also in the preparation of creosote (q.v.).

Wool, that soft species of hair which grows on sheep; the outer covering of other animals somewhat similar to sheep, e.g. several species of goat, provides a fibre which closely resembles certain kinds of wool. The wool fibre obtained from the fleeces of sheep is divided into a comparatively large number of classes according to the length, colour, fineness or coarseness, and to the kind of sheep from which it is taken. There may be twenty or more kinds which are often distinguished by the counts of yarn which may be spun from them, say from 150^s to 20^s or even lower, or else by a quality number which varies from 100^s to 28^s. Wool fibre may be any length up to 12 inches or slightly over, and, in general, the longest fibres are used for worsted or combed yarns, and the shorter ones, including the noils, used for woollen yarns or corded yarns. This general distinction, however, is not absolutely universal, as a considerable quantity of long-fibred wool is made into hosiery yarns by the woollen method of spinning. Wools which unite a high degree of fineness and softness with considerable length of staple bear a high price. English-bred sheep produce a good, strong, combing wool, that of the Scotch breeds being somewhat harsher and coarser. The finest carding wools were formerly exclusively obtained from Spain, the native country of the merino sheep, and at a later period extensively from Germany, where that breed had been successfully introduced and cultivated. Immense flocks of merinos are now reared in Australia, South America, and South Africa, and from these regions Britain now obtains her chief supply.



Wool fibres, as seen under the Microscope

Woollen Manufacture. The conversion of wool fibres into yarn-like form by rudimentary processes is probably conducted more easily than the somewhat analogous conversion of vegetable filaments, and hence wool fibres would probably be used for such purposes before any other of the present-day textile fibres. Modern methods of converting wool fibres into woollen or worsted yarns and cloth are as intricate as those which are practised for the conversion of any other fibre into textile products. Wool has been used in these islands for a great number of years, and several conditions have contributed to the ultimate establishment of the chief centres of the woollen industry. Possibly three-quarters, or even more, of the entire British woollen and worsted industry is centred in the West Riding of Yorkshire, where the chief seats are Bradford, Leeds, Huddersfield, Halifax, and Keighley (and the small towns and villages adjoining these places), and the so-called 'Heavy Woollen District', which includes Dewsbury, Batley, Morley, Ossett, Mirfield, Heckmondwike, Birstal, Guiseley, Yeadon, &c. The remainder of the industry is spread over districts which are situated in the south of Scotland (Galashiels, Hawick, Selkirk, &c.), west of Scotland (Glasgow and district, Ayrshire, &c.), the west of England (Stroud, Trowbridge, &c.), the midlands of England (Leicester, &c.), and parts of Wales and Ireland. The production of woollen yarn for woollen goods is quite distinct from that for worsted yarns, although both kinds of yarn are made from wool fibres. The wool staplers clip, sort, and classify the locks of wool from several different parts of the fleece, and supply many manufacturers with the raw material. Large firms of manufacturers employ their own wool sorters. The fleece of wool is spread on an open-mesh wire riddle which is raised about 6 inches from an open drawer, and the latter, as well as the riddle, is supported by a table or stand. During the process of clipping and sorting, most of the foreign matter—dirt, sand, and the like—passes through the riddle into the open drawer. The sorted wool in the unwashed state contains a natural grease termed yolk or suint, and this, in addition to any dirt which remains after sorting, is wholly or partially removed by means of a specially designed machine termed a wool-scouring machine. Here the fibres are fed to the feed rollers, and caused to pass through a mild alkaline bath by means of suitable propellers and grates. As the wool emerges at the opposite end of the machine, it is squeezed between rollers, and afterwards dried by automatic drying machines or other means. In spite of the gentle treatment in the wool-scouring and drying machines, the fibres have a natural tendency to adhere to each other, so it is usual to pass the dried material through a teasing machine, which disentangles the fibres and removes most of the dirt which may have escaped removal in the preceding processes. If the wool contains burrs (sharp-pointed seeds), they are removed either by the burring machine or by a carbonizing process. The teased wool may be used alone, or, as is often the case, mixed with other qualities of wool, or even with other textile fibres, to form a mixture or 'blend'. The necessary quantity of each material is laid in horizontal layers, one above the other, on the floor of the willey-house, each layer being oiled, unless the oiling is to be done automatically in the tenter-hook willey or 'fearnought'. This machine really performs a preliminary carding action, as it is provided with a cylinder, workers, and strippers, each roller being covered with teeth. The operative takes vertical sections from the blend or pile and spreads them on the feed table of the willey; the table conveys the fibres to the nip of the rollers, which carry the material to the above-mentioned group of rollers, and the latter card the fibres slightly, open them, and ultimately convey them to the delivery side, where they are blown into a closed-in compartment usually formed by hessian cloth. The real carding action takes place in the next machine, termed a scribbler; this machine is provided with two or more cylinders, and on approximately half the periphery—the upper half—of each are the workers and strippers, while at intermediate stages are the angle strippers, fancy, and doffers. Each roller is covered with fine card clothing (thousands of bent wires, the free ends of which manipulate the fibres in various ways). The treated fibres are doffed in the form of a thin sheet, and this sheet has to be delivered to the condensing machine. In some cases the thin sheet is formed into a lap, or it may be contracted to the form of a sliver; but in every case the material is conveyed, invariably automatically, from the scribbler to the condenser, where the material is further treated and separated into narrow strips, about 1½ inches wide, either by a tape condenser, by single-ring doffer, or by double-ring doffer, each doffer taking alternate narrow widths from the sheet. Finally, the separated narrow strips are passed between and rubbed or rolled by pairs of endless rubbers, and then in their rounded form, termed slubbing or rove, are wound on to wide condenser bobbins. These bobbins, each of which contains from twenty to forty slubbings, are taken to the creel of the spinning mule (q.v.). After the yarn is spun on the mule into warp and weft, warps or chains are made from the warp and beamed on to the weaver's beam. Then both warp and weft are interwoven in the well-known way to form various kinds of cloth. When the cloth leaves the loom, it is perched, knotted, mended, milled or felted in milling machines or in fulling stocks, washed, hydro-extracted, tentered or dried, raised, brushed, cut or cropped, steamed, pressed, &c., according to requirements. Lastly, the piece is burled, and if any damages are present, they are repaired by a fine-drawer. The above processes from perching onwards refer mostly to the operations conducted on army, navy, and police clothing, doeskins, pilots, beavers, and the like. Napping and witneying machines are also used for certain kinds, and numerous other finishes are applied according to the effect required in the finished fabric. Processes involving dyed material in fibre form, yarn state, or in piece goods are naturally extensively practised, because coloured goods in woollen form by far the bulk of the trade. When pieces are dyed, several of the above processes of finishing have to be performed after the cloth leaves the dye-house.

Woolner, Thomas, British sculptor, was born at Hadleigh, Suffolk, 1825, died 1892. He studied under William Behnes, and exhibited his first notable life-size group, *The Death of Boadicea*, in 1844. This was followed by *Puck*, *Titania*, and *Eros and Euphrosyne*. Besides his well-known statues of Carlyle, Tennyson, Gladstone, Newman, Darwin, Kingsley, &c., his more celebrated works are: *Elaine with the Shield of Sir Lancelot*, *Ophelia*, *In Memoriam*, *Virgilia bewailing the Banishment of Coriolanus*, and *Achilles and Pallas shouting from the Trenches*. Woolner also achieved some success as a poet.

Woolsack, a large square bag of wool, without back or arms, covered with red cloth, which forms the seat of the Lord Chancellor of England in his capacity of Speaker of the House of Lords. It is said to have been placed in the Upper House in the reign of King Edward III to remind the peers that the wool trade was England's staple industry.

Woolwich (wụl′ich), a metropolitan municipal and parliamentary borough of England, on the Thames, 8 miles below London Bridge. It stretches about 3 miles along the south bank of the river, and owes its importance to the great arsenal, which has a circumference of 4 miles, and comprises gun- and carriage-factories, forges, foundries, workshops, laboratory, barracks, &c., with vast magazines of warlike stores. North Woolwich, with various industries, on the north side of the river, is connected by steam ferry. Pop. 140,400.

Woonsocket, a city of Rhode Island, United States, in Providence county, on Blackstone River; served by the New York, New Haven, & Hartford Railway. Its manufacturing establishments include cotton- and woollen-factories, machine-shops, rubber-works, and iron-foundries. Settled about 1666, it became a city in 1888. Pop. (1920), 43,496.

Worcester, the county town of Worcestershire, and one of the most ancient cities of England, on the Severn, 114 miles north-west of London. Its most notable building is a Gothic cathedral, originally built in 680 and rebuilt in the beginning of the thirteenth century. Among other buildings are the shire hall, the guildhall, corn exchange, museum of natural history, &c. Worcester is the chief seat of the English leather glove trade, has celebrated porcelain-works, sauce-works, foundries, carriage-factories, and other works. Pop. (1921), 48,848.

Worcester, a city of Massachusetts, United States, the county seat of Worcester county, on Blackstone River; served by the Boston & Albany Railway. It is the second largest city in the state, and an important educational and manufacturing centre. Steelworks, the making of wire rope, and hardware, provide the chief employments. Settled in 1684, it became a city in 1848. Pop. 179,750.

Worcester College, Oxford, originally called Gloucester Hall, was founded in 1714 by Sir Thomas Cookes of Bentley, Worcestershire.

Worcestershire, a county of England, is bounded north by Shropshire and Staffordshire, east by Warwickshire, south by Gloucestershire, and west by Herefordshire; area, 458,352 acres. The surface is a broad plain varied by the Malvern Hills in the south-west, several valleys, of which the Severn is the most notable, and having as its chief rivers the Severn, Stour, Teme, and Avon. The soil, which is mostly of clay, is well adapted for wheat, which is extensively grown, while hop gardens are numerous. Coal and iron are worked in the Dudley district; there are large manufactures of iron, steel, and hardware; and salt is obtained from the salt springs at Droitwich. The carpets of Kidderminster are famous, as are also the gloves and porcelain of Worcester, and there are important glass manufactures at Dudley and Stourbridge. Pop. (1921), 405,876.

Wordsworth, William, English poet, was born on the 7th April, 1770, and died on the 23rd April, 1850. He was a son of John Wordsworth (1741–83), a prosperous attorney of Cockermouth, and law-agent to James Lowther, first Earl of Lonsdale (creation of 1784). The other children of John Wordsworth were Richard (1768–1816); Dorothy (1771–1855), William's devoted companion, and celebrated for her *Journal*; John (1772–1805), drowned at sea; and Christopher (1774–1846), subsequently master of Trinity College, Cambridge, and one of the founders of the classical tripos. Other distinguished members of the family are Christopher's sons, Christopher (1807 – 85), who was headmaster of Harrow (1836–44) and became Bishop of Lincoln in 1869; Charles (1806–92), who became warden of Trinity College, Glenalmond (1846–52), and Bishop of St. Andrews, Dunkeld, and Dunblane; and John (1843–1911), son of the Bishop of Lincoln, who became Bishop of Salisbury in 1885.

Wordsworth was educated at schools at Cockermouth and Penrith, and at the age of eight went to the grammar-school at Hawkshead, where he chiefly appreciated the freedom from supervision. He read many of the best authors, Cervantes, Le Sage, Swift, and Fielding, and mastered the *Arabian Nights* in an abridged edition. He was an active boy, and delighted in fishing, boating, riding, walking, skating, and every form of exercise. When his father died, the poet was thirteen years of age, and was put in the charge of guardians, who sent him to St. John's College, Cambridge, in 1787. His time at Cambridge was not profitably spent, and he took a poll-degree in 1791. The outstanding feature of his college days was a Continental trip which he took during the long vacation of 1790 with his friend Robert Jones. While in France, he laid the foundations of his short-lived republican ardour. In 1791 and 1792 he again went abroad, on the pretext of learning enough French to qualify him for the post of travelling tutor. He visited Paris, Orleans, and Blois, and almost threw his lot in with the Girondins. He returned to England in Dec., 1792, and for some years led a desultory life, obstinately refusing to follow a definite profession. Early in 1793 he published his *Evening Walk* and *Descriptive Sketches*. These poems are immature and conventional, but they contain vivid pictures of nature, drawn by one who evidently believed in the educative value of "One impulse from a vernal wood". In the same year he wrote a prose letter to the Bishop of Llandaff, who had attacked the revolution. A timely legacy of £900 from a friend Raisley Calvert permanently removed Wordsworth from the danger of having to enter the Church or the legal profession. In 1795 he settled with his sister at Racedown, in Dorsetshire, where he wrote some Juvenalian satires which he suppressed, and a tragedy, *The Borderers*, a typical closet-drama, not published until 1842. He was gradually casting the slough of his republican opinions, but the process was a slow and somewhat painful one. In 1795 he met Coleridge; their meeting had a far-reaching effect upon the work of both. In 1797 Wordsworth moved to Alfoxden, in Somersetshire, in order to be near Coleridge, who was then living at Nether Stowey. They were visited by Lamb and Hazlitt. In Sept., 1798, Wordsworth and Coleridge published jointly their famous *Lyrical Ballads*, "for money and for money alone", as Wordsworth himself said. Wordsworth supplied the bulk of the poems; *The Ancient Mariner* and three other poems are the work of Coleridge. The authors received thirty guineas for the book, but its sale was slow, and each of them blamed the other for its ill-success. It contained some of Wordsworth's best work, such as *We are Seven*, *Simon Lee*, and *Lines composed a few miles above Tintern Abbey*, but it also contained some feeble and prosaic effusions. In 1798 the Wordsworths settled at Goslar, in Germany, with the intention of studying German and natural science. They returned to England after six months without having acquired much of either. They had been prepared to stay two years. Late in 1799 they settled at Dove Cottage, Grasmere, where Wordsworth steadily laboured in his vocation. A second edition of *Lyrical Ballads* appeared in 1800, with a famous preface by Wordsworth, who stated therein his theory of poetic diction, asserting that "there is no essential difference between the language of prose and metrical composition". Wordsworth certainly had a strong case against the diction of much contemporary poetry, a diction which was almost as corrupt and absurd a jargon as the 'law-French' of the seventeenth century. Like most advocates, however, he overstated his case, and was led into a paradoxical and unwarrantable eulogy of the language of rustics, thereby laying himself open to much ridicule. In 1802 the Earl of Lonsdale, who had refused to pay his debts to the Wordsworth family, died, and his heir honourably discharged his obligations. Wordsworth and his sister each received about £1800; on the strength of this Wordsworth, in Oct., 1802, married Mary Hutchinson, whom he had known all his life. Dorothy still remained a member of his household. Wordsworth had visited Scotland in 1801, and went there again in 1803 with his sister and Coleridge, visiting the Burns country and making the acquaintance of Scott. Dorothy Wordsworth's *Recollections of a Tour made in Scotland, A.D. 1803* was edited in 1874 by Principal Shairp of St. Andrews.

In May, 1805, Wordsworth finished *The Prelude, or Growth of a Poet's Mind*, a poem which was intended to bear the same relation to *The Recluse* that "the Ante-chapel has to the body of a Gothic Church". *The Recluse* was to be "a philosophical poem, containing views of Man, Nature, and Society", and owed its name to the fact of its "having for its principal subject the sensations and opinions of a poet living in retirement". The first book of the first part of *The Recluse* was written, but not published until 1888; the second part, *The Excursion*, was completed and published in 1814; the third part was only planned. In 1807 Wordsworth published a collection of poems in two volumes, including the *Ode to Duty*, the *Intimations of Immortality from Recollections of Early Childhood*, *Miscellaneous Sonnets*, *Sonnets dedicated to Liberty*, and other poems. In 1809 he published a pamphlet *Concerning the Relations of Great Britain, Spain, and Portugal to each other, and to the Common Enemy, at this Crisis*. It was written in an eloquent but involved style; the complexity of Wordsworth's prose is a striking contrast to the simplicity of his poetry. Wordsworth had moved from Dove Cottage to Allan Bank in 1808, and had gone to the parsonage at Grasmere in 1810. Early in 1813 he moved to Rydal Mount, where he lived until his death. In 1813 he was made Distributor of Stamps for the county of Westmorland, an office which brought him in about £400 a year. His duties were light. In 1814, the year in which *The Excursion* appeared, he visited Scotland again. *The White Doe of Rylstone* appeared in 1815, *Peter Bell* and *The Waggoner* in 1819, and *Ecclesiastical Sketches* in 1822. By this time Wordsworth had published his best work; the rest of his life, save for some travels at home and abroad, was uneventful. He travelled on the Continent in 1820, 1823, 1828, and 1837, in Ireland in 1829, in Scotland in 1831 (visiting Scott and writing *Yarrow Revisited*), and again in 1833. Many of Wordsworth's friends died long before he did, and he felt keenly the deaths of Scott (1832), Coleridge (1834), and Lamb (1834). His beloved sister Dorothy was extremely ill in 1829, and never regained her health, though she lived twenty-six years longer with impaired mental faculties. Wordsworth's importance as a poet was recognized after the publication of Coleridge's *Biographia Literaria* in 1817, and was acknowledged more and more widely as time went on. In 1838 he was made an honorary D.C.L. of Durham; in 1839 he received the same degree at Oxford, and was enthusiastically welcomed. In 1842 he resigned his place in the Stamp Office, and was granted a Civil List pension of £300. After the death of Southey (1843) Wordsworth was made Poet Laureate; he would not have accepted the post if he had not thought that the duties were purely nominal. His one official poem was probably written by his son-in-law. Wordsworth died peacefully at Rydal Mount in 1850, and was buried in Grasmere Churchyard. His poetic laurels, " greener from the brows of him that utter'd nothing base ", fell to the lot of Tennyson.

Wordsworth had unique gifts as a poet; but the story of his mental development is a more or less commonplace one. To change from republicanism and heterodoxy to conservatism and the Church of England has been the experience of many. His beliefs, however, are of less value than his analysis of how he acquired them, although some readers care less for the means than for the end in such matters. He has given us a most valuable picture of the growth of a poet's mind; with all reverence it may be said that in almost all his best poems the bard is the hero of his story. In the notes upon the composition of his poems Wordsworth has prevented foolish conjectures at the expense of giving a good deal of irrelevant detail, and disillusionizing his readers much as Trollope (q.v.) afterwards did. In his formal attacks upon poetic orthodoxy—his prefaces, &c.—he did not state his case very clearly, and was led into a paradoxical side-issue. His theory of the eloquent rustic is as great a fallacy as the companion theory of the noble savage. Wordsworth has suffered much from injudicious admirers, from those who would make it a pious article of belief that everything he wrote is good. Between his best work and his worst there is a great gulf fixed, wider than that which separates the best and the worst work of any other equally great poet. He " utter'd nothing base " in the moral sense of the word; but from the point of view of art there is much base metal in his writings, nor did he himself possess any touchstone which enabled him to distinguish this base metal from gold. He passed through the needle's eye of Matthew Arnold's approval only after dropping much of his poetical baggage. His best poems are beyond all praise; to discuss his worst " were to waste criticism upon unresisting imbecility, upon faults too evident for detection, and too gross for aggravation ". Lamb said of him that his standard of intoxication was miserably low; his standard of inspiration was even lower. All his best work was written between 1798 and 1808. It is to be noted that he always wrote better when he was out of his rut; travel or excitement acted on him like wine. On the strength of his best work he stands among the greatest of English poets, and takes a place near Virgil as a lover and interpreter of nature. George Borrow in *The Romany Rye* (chap. xxii) ironically praised the soporific qualities of Wordsworth's pedlars and rustics, whose talk, mostly on subjects moral or metaphysical, was " couched in the most gentlemanly and unexceptionable language, without the slightest mixture of vulgarity, coarseness or pie-bald grammar ". He wrote truer than he knew. Wordsworth's best poems are an anodyne for those who find the world too much with them; like sleep, they " knit up the ravell'd sleave of care ", and are " balm of hurt minds, great nature's second course ".—BIBLIOGRAPHY: Matthew Arnold, *Essays in Criticism* (second series); S. T. Coleridge, *Biographia Literaria*; C. H. Herford, *The Age of Wordsworth*; E. Legouis, *The Early Life of Wordsworth*; W. Knight, *Wordsworth's Poetical Works* (with a life in 3 vols.); Sir W. Raleigh, *Wordsworth*; H. Crabb Robinson, *Diary*; Christopher Wordsworth, *Memoirs of W. Wordsworth*.

Work, in physics, is defined as the product of a force by the distance which its point of application moves in the direction of the force. If the point of application of a force F moves along a straight line of length s, and if the direction of the force makes an angle θ with the straight line, then the work done, according to this definition, is $Fs \cos\theta$. The chief British units of work are the foot-pound (q.v.) and the foot-poundal. In the C.G.S. system the unit of work is the *erg*, which is the work done when the point of application of a force of 1 dyne moves through 1 cm. A joule is ten million, or 10^7, ergs. The unit of power called the *watt* (q.v.) is equivalent to 1 joule per second. See *Dynamics*; *Energy, Physical.*

Workington, a market town and seaport of Cumberland, England, at the mouth of the Derwent. Its industrial establishments comprise large iron-smelting works and works for steel rails, iron plates, shipbuilding, &c., while there is a considerable shipping trade. Pop. (1921), 26,480.

Workmen's Compensation. See *Employers' Liability Act.*

Worksop, a market town of Nottinghamshire, England, 26 miles north of Nottingham. It has a beautiful Norman church. Worksop is an agricultural centre with a cattle market, and has also sawmills and chemical-works. Pop. (1921), 23,198.

Worms, a term loosely applied to many more or less elongated creeping animals, entirely wanting feet or having but very short ones, including such various forms as the earthworm, the larvæ or grubs of certain insects, intestinal parasites, as the tape-worm, thread-worm, &c. In zoological classifications it is used as equivalent to Vermes. In medicine it is applied to the parasitic animals (entozoa) which exist chiefly in the intestines, and to the disease due to the presence of such parasites. Several kinds of worms may infest the human body, but the worms with which children are so commonly annoyed are the small worms known as thread-worms (*Oxyuris vermicularis*). Vermifuges or anthelmintics are names given to medicines that cure worms, such as extract of male-fern root for tape-worms, santonin for thread-worms. See *Wormwood*; *Tape-worms*; *Nematelmia.*

Worms (ancient **Borbetomagus**), a city of Germany, in the Rheinhessen division of the German Republic of Hesse, on the Rhine; served by the Mainz-Weissenburg, Worms-Darmstadt, and other lines. The chief buildings of interest are the Romanesque cathedral (consecrated 1181); the Liebfrauenkirche and church of St. Martin; the town-house; and the monument to Luther, consisting of a colossal statue on a raised platform surrounded by figures of precursors of or persons directly connected with the Reformation. At Worms was held the famous diet in 1521, at which Luther defended his doctrines before the Emperor Charles. Pop. (1919), 44,290.

Wormwood, the common name of several plants of the genus Artemisia. Common wormwood (*A. Absinthium*), a well-known plant, is celebrated for its intensely bitter tonic and stimulating qualities, which have caused it to be an ingredient in various medicinal preparations, and even in the preparation of liqueurs. It is also useful in destroying worms in children.

Worsted is the name given to yarns made from the wool fibre by a process of combing as distinct from carding. By this process all the fibres are placed parallel to each other. The yarns are woven into all kinds of fine suitings and fabrics, as well as knitted into the finer makes of hose, sports-coats, jumpers, &c. The name is from Worsted, a village in Norfolk, where it is supposed to have been first manufactured. See *Woollen Manufacture.*

Wörth, the German name of the French *Woerth-sur-Sauer*, a town of France, department ot Bas-Rhin, on the Sauer; served by the Lembach-Walburg (for Wissembourg) Railway. At Wörth, during the Franco-German War, MacMahon was defeated by the Crown Prince of Prussia (6th Aug., 1870). *Reichshofen* is the French name for the battle. Pop. 2000.

Worthing, a watering-place of Sussex, England. It is a fashionable resort, having an esplanade, libraries, reading-rooms, &c. Pop. (1921), 35,224.

Wotton, Sir Henry, English diplomatist and poet, born 1568, died 1639. He was educated at Winchester and Oxford; resided on the Continent for some years, and on returning to England was employed as secretary to Essex. On the fall of that nobleman from power (1600) Wotton fled to Florence, where he was employed by the grand-duke to reveal to King James of Scotland a plot against his life. When the Scottish king ascended the throne of England, he showed his gratitude by making Wotton a knight, employing him abroad as an ambassador, and ultimately (1624) appointing him provost of Eton. His ability as a writer is shown in *Reliquiæ Wottonianæ*, published in 1651, with Izaak Walton's *Life of Wotton.*

Wound, in surgery, a breach of continuity of any of the tissues of the body, but more particularly the soft parts, involving the surface and produced forcibly. According to this definition, all wounds are 'open' wounds. The surgical classification of wounds takes cognizance of their mode of infliction with the consequent variation in their nature and, above all, their state in regard to infection. Wounds inflicted by the surgeon are not infected by matter carried into them from without, since his instruments are sterilized; but the vast majority of all other

Wormwood (*Artemisia Absinthium*)

wounds are contaminated by the causative instrument or by portions of clothing or even of skin which may be carried into them. All wounds are *incised*, or *lacerated*, or *contused*, or *punctured*, or *poisoned*, or a combination of two or more of these descriptions, e.g. gunshot wounds, which are frequently described separately.

1. *Incised wounds* are those made by sharp cutting instruments. The hair-bulbs of the skin are not left half-embedded in the wall of the wound, but divided. This further distinguishes incised wounds from lacerated and contused wounds. The blood-vessels also are cleanly divided, so that bleeding is free, tending to cleanse the wound, while since the edges are not bruised, healing is rapid and satisfactory usually, provided no deep structures have been involved. The edges, however, tend to gape owing to the elasticity of the skin, and, if the wound is extensive, they require to be coapted by *sutures*.

2. *Lacerated* or *contused wounds* usually bleed little, because the vessels are not cut cleanly but are torn and twisted, the inner coats, which give way first, curling up within the outer covering. Since missiles, machinery, and vehicular wheels are common agents in the infliction of such wounds, the class comprises some of the most extensive and dangerous injuries.

3. *Punctured Wounds.*—In these the essential feature is the disproportion between the visible, superficial injury and the possible damage to important structures beneath.

4. *Gunshot wounds* owe their peculiarity to the high velocity of the missiles producing them. They have typically an aperture of entry somewhat "like a bug-bite" (Treves), and a larger more slit-like aperture of exit. The damage to structures in the neighbourhood of the path of the bullet, but not in it, is usually slight. Bone may, however, be extensively splintered by a direct hit, and, of course, soft tissues—nerves and vessels—severed.

The treatment of wounds is directed to the arrest of bleeding, the sterilization of the wound, the coaptation of opposed surfaces by sutures, and repair and recovery by protection, rest, and attention to the general health of the patient.

Wrangell, Ferdinand, Baron, Russian explorer, born 1794, of Swedish descent, died 1870. He commanded an exploration party (1820–4) on the north-east Siberian coast, and was Governor of Alaska between 1831 and 1836.

Wrangell, or Wrangel Island, an island of the Arctic Ocean, in 71° N. lat., 179° W. long., 80 miles long by 30 miles wide, and about 100 miles from the north Siberian coast. Discovered by Captain Kellett (British) in 1849, the Union Jack was hoisted there by Stefansson in 1914, and again in 1914 by Maurer. In Sept., 1921, the Crawford Expedition, financed by Stefansson, arrived there, but a relief ship failed to reach them (1922), and the Noice Expedition (1923) found only an Eskimo woman, the rest having perished. Soviet Russia, during 1923, laid claim to the island as part of the discoveries (1821) of the Russian explorer Wrangell, but according to Wrangell's own account, he discovered no land north of Siberia. See map under *North Polar Regions*.

Wrangell Island, an island of Alaska, containing Wrangell, a former fort founded in 1833, and now inhabited mainly by Thlinkit Indians. It is noted for local deposits of almandine.

Wrangell Mountain, an active volcano of Alaska; altitude, 17,400 feet (Blackburn Peak).

Wrangler, in Cambridge University, the name given to those placed in the first class in the public examination for honours in mathematics, commonly called the *Mathematical Tripos*. The terms senior, second, &c., wrangler and the system of placing candidates in strict order of merit disappeared after 1909, and the names in each class are now arranged in alphabetical order. The old names of wranglers, senior optimes, and junior optimes are still used, however, for first, second, and third class in part ii of the Mathematical Tripos.

Wrasse (ras), the name of various species of fish belonging to the family Labridæ. They are prickly spined, hard-boned fishes, with large double and fleshy lips. Several species are natives of the British seas, as the ballan wrasse, or old wife (*Labrus tinca* or *maculatus*), which attains a length of about 18 inches.

Wreck, in law, a wrecked vessel or part of it, or of its cargo, including articles of value cast upon land by the sea, and also jetsam, flotsam, ligan, and derelict. The law on the subject of wrecks is contained in the Merchant Shipping Acts. The wreck is taken over by the *receiver of wrecks* for the district in which it is discovered, and kept by such authority for a year, at which time, if no one has established his claim to possession, it becomes the property of the Crown. Should the wreck be of a perishable nature, it can be sold and the proceeds retained instead. Any person found stealing or destroying wreck is chargeable with felony; and a person proved to be in possession of shipwrecked goods, or who offers such goods for sale, may be fined or imprisoned. In the case of plunder or damage to any ship or boat cast ashore, the owner may claim compensation from the district authority.

Wren, Sir Christopher, English architect, born at East Knoyle, Wilts, in 1631, died in London 1723. He was educated at Wadham College, Oxford; became a Fellow of All Souls in 1653; was appointed professor of astronomy at Gresham College in 1657, and three years later was elected

Savilian professor of astronomy at Oxford. He had been appointed by Charles II to restore old St. Paul's, but after the great fire (1666) it became necessary to rebuild the cathedral. In preparing his plans he was considerably hampered by the ecclesiastical authorities, who insisted on a chancel, while Wren wished the church to be in the form of a basilica; but with the king's permission he modified and improved the design as the building proceeded. The cathedral was begun in 1675, and the architect saw the last stone laid by his son thirty-five years afterwards. Among other notable buildings which Wren designed are: the modern part of the palace at Hampton Court; the library of Trinity College, Cambridge; the hospitals of Chelsea and Greenwich; and the churches of St. Stephen's, Walbrook, and St. Mary-le-bow. In 1680 he was chosen president of the Royal Society. Over the north doorway of St. Paul's is a memorial tablet on which are the well-known words: *Si monumentum requiris, circumspice.*

Wren, a name given to certain perching birds of the family Troglodytidæ, distinguished by their small size, slender beak, short, rounded wings, mottled plumage, and the habit of holding the tail erect. The wren proper (*Troglodytes parvulus*) is, with the exception of the golden-crested wren, the smallest bird in Europe, averaging about 4 inches in length. The organ-bird or house-wren (*T. domesticus*) of the Amazonian region is a familiar summer visitant of North America east of the Rocky Mountains. The name 'wren' is also popularly applied to various other small birds, such as the golden-crested wren (*Regulus cristatus*) and the willow-wren (*Phylloscopus trochilus*), both of which belong to the warbler division of the thrush family.

Wrestling, a sport of great antiquity, being known at least 3000 years B.C., has been much practised in all quarters of the globe. It was extremely popular in ancient Greece, whose wrestlers were taught to consider grace of pose and movement, as well as strength and skill, in their contests. The famous wrestler Milo of Croton gained the prize for wrestling six years in succession at the Isthmian and Olympic games. In Britain wrestling was in vogue among the Saxons, continued in favour under the Plantagenet kings, and held its popularity until about two centuries ago. A later attempt to revive it met with little more than local success, the sport being mainly confined to Devon, Cornwall, and the north of England. Wrestlers recognize several different styles of contest, the chief varieties being: (1) the *Cumberland and Westmorland*, in which the opponents clasp their hands around each other's body, with the left arm uppermost; the loser is he who breaks his hold or allows any portion of his person save the feet to touch the ground. (2) The *Lancashire*, or *catch-as-catch-can*, is a form of ground wrestling in which any hold is allowable; two shoulders down count as a fall. (3) In *Cornwall and Devon*, or *catch-hold* wrestling, the wrestlers are allowed to take hold anywhere above the waist or by any part of the jacket; two hips and a shoulder, or two shoulders and a hip upon the ground are reckoned as a fall. The so-called *Greco-Roman* style resembles that of Lancashire, except that tripping and a catch below the waist are both disqualified. The *Scotch* style is a mixture of the Cumberland and Westmorland with the Greco-Roman. See *Jiu-Jitsu*.—Cf. *Fencing, Boxing, and Wrestling* (Badminton Library).

Wrexham, a municipal borough of Denbighshire, North Wales, on the Clywedog. Its church of St. Giles, built about 1470, is one of the finest old Gothic buildings in North Wales. The town has large breweries, tanneries, paper-mills, &c., and there are extensive coal-mines in the neighbourhood. Pop. (1921), 19,002.

Writing. See *Alphabet*; *Cuneiform Writing*; *Hieroglyphics*; *Illumination*; *Manuscripts*; *Ogham*; *Runes*; *Shorthand.*

Wryneck, a bird allied to and resembling the woodpeckers. One species, the common wryneck (*Iynx torquilla*), is a summer visitant of England and the north of Europe. It is remarkable for its long tongue, its power of protruding and retracting it, and the writhing snake-like motion which it can impart to its neck without moving the rest of the body. It feeds chiefly on insects.

Wulfenite, a mineral lead molybdate, colour yellow or orange, one of the sources of molybdenum.

Württemberg (*Volksstaat Württemberg*), a People's Republic of Southern Germany; area, 7534 sq. miles; pop. 2,526,200. Except a few tracts in the south, the surface is hilly and even mountainous. In the west the Schwarzwald, or Black Forest, forms part of the boundary, and the Alb or Rauhe Alp, forming part of the Franconian Jura, covers an extensive tract. The country belongs mainly to the basin of the Rhine, being drained northward into that river by the Neckar, while the Danube flows across the southern districts. A part of the Lake of Constance is also included in Württemberg. The climate is temperate, the mean annual temperature in the mountains being about 40° F., and in the Neckar Valley about 45° F. In the lower and more favourable districts the fig and melon ripen in the open air, and the vine, cultivated on an extensive scale, produces several first-class wines; maize, wheat, hops, tobacco, and fruit, which is employed in cider-making, are largely cultivated. About a third of the country is under forests, which consist chiefly of oaks, beeches, and pine.

Of minerals, by far the most valuable are iron and salt, both of which are worked by the Government. Manufactures consist chiefly of cotton, woollen, and linen goods, paper, wooden clocks, toys, musical instruments, and chemical products. A trunk line of railways ex Munich, and via Ulm, Stuttgart, Ludwigsburg, and Mühlacker, traverses the republic, and runs to Bruchsal (in Baden). There is a State President, who is President of the State Ministry, a body appointed by the Landtag (101 members, elected for four years), which holds supreme power within the republic. In monarchic days the king was invested by the Constitution with the supreme direction and guardianship of the Evangelical Protestant Church. This duty is now performed by a president and councillors, who are represented by commissioners at Ulm, Heilbronn, Ludwigsburg, and Reutlingen. In 1910 the religious distribution was as follows:

Circle.	Area, sq. Miles.	Population (1910).	Religions (1910).		Population (1919).
			Protestant.	R.C.	
Danube (Donau).. ..	2,419	569,216	214,620	351,396	591,142
Jagst	1,985	414,969	275,976	135,475	421,391
Black Forest	1,844	570,820	418,409	147,507	583,524
Neckar	1,286	882,569	762,178	105,617	930,114
Total	**7,534**	**2,437,574**	**1,671,183**	**739,995**	**2,526,171**

Education is generally diffused, and the centre of the educational system is the University of Tübingen. Besides Stuttgart (the capital), the chief towns are: Ulm, Heilbronn, Esslingen, Reutlingen, Ludwigsburg, Göppingen, Tübingen, Gmünd, Heidenheim, Ravensburg, Tuttlingen, Zuffenhausen, and Aalen. Other towns are: Schwenningen (pop. 17,200), Feuerbach (16,800), Geislingen (13,500), Ebingen (11,200), Schwäbisch-Hall (q.v.), Cannstadt (q.v.), and Plochlingen.

Previous to the Napoleonic era the rulers had the title of duke, but in 1806, by the favour of Napoleon, the reigning duke gained a great accession of territory, as well as the title of king. In the subsequent arrangement of the European states by the Congress of Vienna the territorial accessions were confirmed and the kingly title formally recognized. In the war of 1866 Württemberg sided with Austria against Prussia, but became a member of the German Empire on its foundation in 1871, and the royal House fell in Nov., 1918, when the republic was proclaimed.

Würzburg (Rom. *Wircebirgum*), a city in the Republic of Bavaria, on the Main. It is dominated by the fortress of Marienberg. The most important edifices are the Romanesque cathedral, erected in 1042 in place of a foundation of 862; the university; the Julius hospital and school of medicine; and the palace (1720–44). The university library has 200,000 volumes. Pop. (1919), 86,571.

Würzburg was a concentration place for troops of the German Empire, and its railway communications are extensive. The main line is the Frankfurt-Aschaffenberg-Gemünden (for Schweinfurt) - Würzburg system, which bifurcates at Würzburg for Treuchtlingen, via Kitzingen and Nürnberg (the route followed by the Vienna-Ostend express), or via Ansbach and Gunzenhausen. Direct services are maintained to Regensburg (for Passau), via Nürnberg, to Bamberg, via Schweinfurt, and to Heidelberg.

Wurzen, a town of Saxony, on the Mulde; the junction for Glauchau, on the Leipzig-Dresden railway. Iron - founding, bleaching, weaving, paper-, piano-, and leather-making are the chief industries. Pop. 20,000.

Wy'andots (in Canada called *Hurons*), an Indian tribe in North America belonging to the Iroquois family. In the beginning of the seventeenth century they were settled on the eastern shore of Lake Huron, but in a tribal war (1636) they were nearly exterminated by the Iroquois.

Wyatt, Sir Thomas, English poet and diplomatist, the first writer of sonnets in the English language, born 1503, died 1542. His poetical works, which include elegies, odes, and a metrical translation of the *Psalms*, were published in 1557, along with those of his friend the Earl of Surrey.

Wycherley, William, English dramatist, was born about 1640, and died in 1716. He was educated in France, in order to avoid the Puritan influences which dominated English education during his youth, and at Queen's College, Oxford, where he did not matriculate, much less graduate. He was admitted a member of the Inner Temple in 1659, but only acquired sufficient law to enable him afterwards to depict the litigious Widow Blackacre in *The Plain Dealer*. There is some doubt as to when he wrote his four comedies. He told Pope 'over and over' that he wrote *Love in a Wood* when he was but nineteen, *The Gentleman Dancing-Master* at twenty-one, *The Plain Dealer* at twenty-five, and *The Country*

Wife at one or two and thirty. It is almost certain that he antedated the composition of all these plays in order to boast of his own precocity. The dates of the production of the comedies appear to have been: *Love in a Wood*, 1671 (published the same year); *The Gentleman Dancing-Master*, 1671 (published 1673); *The Country Wife*, 1672 (published 1675); and *The Plain Dealer*, 1674 (published 1677). Wycherley's first comedy secured for him an intimacy with the notorious Duchess of Cleveland, an intimacy which did not prevent the king from being on friendly terms with him. He would have been appointed tutor to Charles's natural son, the Duke of Richmond, had he not with great imprudence married the Countess of Drogheda, who, after making him thoroughly unhappy, died and bequeathed to her husband a law-suit instead of a fortune. Wycherley's old age was not a happy one. His health was poor, his memory weak, and he was constantly in debt. When he was sixty-four he struck up a friendship with Pope, then a lad of sixteen. Pope was asked to correct some of Wycherley's poems, and did so with so much thoroughness that his friendship with the aged comedy-writer was more than once broken off. Long afterwards Pope published his correspondence with Wycherley, after editing it so as to make his own conduct appear in a favourable light. Ten days before he died Wycherley married a young girl in order to spite the nephew who was his heir.

Wycherley's *Miscellany Poems* (1704) and *senilia* may be left entirely out of account when estimating his work. He owes his fame to his four comedies. *Love in a Wood* is, as is natural, the least mature of his plays, but it is a sufficiently lively and witty comedy. It is usually said to be modelled on Sir Charles Sedley's *The Mulberry Garden*, but the resemblance is slight, nor is it certain that Sedley's play is the earlier of the two. *The Gentleman Dancing-Master* was a better, though a less successful play. It borrowed its central incident from Calderon's *El Maestro de Danzar*, a comedy of minor importance. *The Country Wife* is a splendid comedy, marred only by the obscenity which is in grain in it. Garrick, who produced an emasculated version of it known as *The Country Girl* (1766), merely made it insipid. It owes one or two incidents to Molière's *L'École des Femmes* and *L'École des Maris*. *The Plain Dealer*, based on Molière's *Le Misanthrope*, is its author's masterpiece. It is excellent from its mocking dedication to its sarcastic epilogue, though of course inferior to Molière's masterpiece. As Voltaire said, "All Wycherley's strokes are stronger and bolder than those of our *Misanthrope*, but then they are less delicate, and the rules of decorum are not so well observed in this play". Manly is a vigorously drawn character, and Fidelia,

> "Who went to sea for love of he
> In masculine array",

though far below Viola in *Twelfth Night*, is not without a certain pathos. Wycherley was second only to Congreve among the fine gentlemen who wrote comedies of repartee after the Restoration. He owes his lack of reputation to certain qualities which he shares with Juvenal. When he castigates vice he depicts it too realistically.—Cf. Charles Perromat, *William Wycherley: sa vie, son œuvre.*

Wycliffe, Wickliffe, Wiclif, Wyklyf, &c., John, English reformer, born about 1320 at Hipswell, near Richmond, in Yorkshire, died 31st Dec., 1384. He was educated at Oxford; was elected master of Balliol College, and in 1361 was appointed rector of Fylingham, or Fillingham, in Lincolnshire. He afterwards became doctor of theology and teacher of divinity in the university; and for some time held the living of Ludgershall, in Buckinghamshire. Disputes existed at this period between Edward III and the Papal court relative to the homage and tribute exacted from King John, and the English Parliament had resolved to support the sovereign in his refusal to submit to the vassalage. Wycliffe came forward on behalf of the patriotic view and wrote several tracts, which procured him the patronage of John of Gaunt, Duke of Lancaster. In 1374 he was one of the commissioners sent by the king to Bruges to confer with the nuncio of Gregory XI respecting the statutes of provisors and præmunire. Shortly before, Edward gave him the valuable rectory of Lutterworth, in Leicestershire, which he held till his death. Here he laboured zealously and unweariedly as a preacher and pastor, though he lived at times also in Oxford or London. In some of his utterances he is said to have styled the Pope Antichrist, charging him with simony, covetousness, ambition, and tyranny. His opinions began to spread, and the Church grew alarmed. Courtenay, Bishop of London, summoned him to appear before a convocation at St. Paul's. Wycliffe appeared there on 19th Feb., 1377, attended by his friends, John of Gaunt (then the virtual ruler of England), Lord Percy, the earl-marshal, and others. Hot words passed between the bishop and the duke; blows followed; and the meeting broke up in confusion. In May following the Pope addressed three Bulls to the king, the primate, and the University of Oxford, commanding them to take proceedings against Wycliffe, who in answer to the prelate's summons appeared in the chapel of Lambeth. Proceedings were, however, stopped by order of the queen-mother, and Wycliffe was dismissed with simply an injunction to refrain from preaching the obnoxious doctrines. About this time he was engaged in translating the Bible from the *Vulgate* with the assistance of some of his friends. In 1381 he publicly challenged the doctrine of transubstantiation, and his heresies were condemned by the theologians of Oxford, as well as by a provincial council called by Archbishop Courtenay and held at the Blackfriars, London, in 1382. Wycliffe was proclaimed a heretic, his works were condemned to be burned, and some of his followers were imprisoned; but he was allowed to retire unmolested to his rectory of Lutterworth. About thirty years after his death his doctrines were condemned by the Council of Constance, and in 1428 his remains were dug up, burned, and the ashes cast into the Swift. The influence of his doctrines spread widely on the Continent, and may easily be traced in the history of the Reformation. Wycliffe was the author of an enormous number of writings in Latin and English, and he ranks undoubtedly as the father of English prose. Many of his writings still remain in manuscript, and it was not until 1850 that the whole of his Bible appeared.—BIBLIOGRAPHY: Lewis Sergeant, *John Wyclif: Last of the Schoolmen and First of the English Reformers*; J. N. Figgis, *Typical English Churchmen*; G. V. Lechler, *John Wycliffe and his English Precursors*; T. Arnold (editor), *Select English Works of John Wyclif*; J. C. Carrick, *Wycliffe and the Lollards* (World's Epochmakers).

Wycombe, High, or **Chepping,** a municipal borough of Buckinghamshire, England, on the Wye. Its chief building is the church of All Saints, built about A.D. 1273, and its chief industry is chair-making. Pop. (1921), 21,952.

Wye, a river of South Wales, which rises on Plynlimmon, in Montgomeryshire, passes through Radnorshire, Brecknockshire, and Herefordshire, and falls into the Severn near Chepstow (Monmouthshire) after a course of 130 miles.

Wykeham, William of, English prelate, statesman, and architect, was born at Wykeham, Hampshire, in 1324, died 1404. Having taken holy orders, he was elevated to the rich see of Winchester, and in 1367 was appointed to the chancellorship of England. He founded (1387) the famous public school or college at Winchester, and about the same time a college at Oxford, now called New College.

Wyndham, Sir Charles, British actor, born 1837, died 1919. Educated for the medical profession, he early adopted the stage as a career, and made his first appearance in 1862. He became famous by his acting in *David Garrick*. From 1885 Miss Mary Moore, whom he married in 1916, was in association with him. He was knighted in 1902.

Wyntoun, Andrew (*Androw*), Scottish chronicler, who lived in the early part of the fifteenth century, was a canon regular of St. Andrews, as also prior of St. Serf's Inch, in Lochleven. His *Chronicle*, which is in the Scottish vernacular, and is called the *Orygynale Cronykil of Scotland*, begins with the creation of the world, and is brought down to the death of Robert III in 1406. It is ascribed to the reign of James I, and was completed about 1426. The first five books contain an outline of general history and geography, the four remaining books dealing with Scotland. The work was edited by David Laing for The Historians of Scotland Series (1872; second edition, 1906), and his edition (2 vols.) is founded on that of David Macpherson, published in 1795.

Wyo′ming, one of the United States of America (admitted June, 1890). It is almost rectangular in shape, situated north of Utah and Colorado, west of Nebraska and South Dakota, and south of Montana; area, 97,914 sq. miles. The surface is to a large extent mountainous, the main chain of the Rocky Mountains extending from north-west to south-east. The river system includes the Platte River with its tributaries in the south-east, the Green River in the south-west, and the Yellowstone, Big Horn, and Powder Rivers in the north. The mountainous districts abound in forests, and the soil of the valleys is a fertile loam very suitable for agriculture. Wheat, oats, and barley are the chief crops, and large tracts are used for stock-raising. The climate is arid, and the rainfall so precarious that irrigation has to be adopted on the arable lands. The chief minerals are gold, silver, copper, tin, iron, petroleum, and coal, the last now extensively mined. Of the larger animals, grizzly and black bears and several species of deer are still abundant, but the buffalo, of which there used to be immense herds on the plains, are now nearly extinct.

Acquired by purchase from France, this territory was organized in 1868. In the north-west the Yellowstone district has been set apart by the Government as a great national park. The capital is Cheyenne City. Pop. (1920), 194,402.

X

X, the twenty-fourth letter of the English alphabet. Except when used at the beginning of a word, *x* in English is a double consonant, and has usually the sound of *ks*, as in *wax*, *lax*, *axis*, &c.; but when terminating a syllable, especially an initial syllable, if the syllable following it is open or accented, it often takes the sound of *gz*, as in *exhaust*, *exalt*, *exotic*, &c. At the beginning of a word it has precisely the sound of *z*.

Xanthus, an ancient city of Asia Minor, the principal city of Lycia, on the River Xanthus. Its ruins were discovered in 1838 by Sir Charles Fellows, who removed many marble monuments, &c., and placed them in the British Museum during 1842 and 1843.

Xavier, St. Francis (zav′i-ėr; Spanish pron. *h*åv-i-er′), surnamed the *apostle of the Indies*, was born in 1506 at the castle of Xavier in Navarre, and died in 1552. He fell under the personal influence of Ignatius Loyola, and became one of the first members of Loyola's Society of Jesus. Appointed Papal nuncio in the Indies (1542), he reached Goa, where, and in other parts of India, notably in Travancore, he prosecuted with success his missionary labours. After proselytizing in Ceylon, Malacca, and the Moluccas, he established a mission in Japan. In 1552 he started for China in the hope of converting it to Roman Catholic Christianity, but died when at no great distance from Canton. He was canonized in 1621.

Xenia, a city of Ohio, United States, the county seat of Greene county; served by the Hamilton & Dayton Railway. It is an agricultural centre, which, founded in 1797, became a city in 1870. Pop. 10,000.

Xenoc′rates, of Chalcedon, Greek philosopher, a disciple of Plato, born 396 B.C., and from 339 until his death (314 B.C.) head of the Academy at Athens. Metaphysics and ethics were his chief subjects, but of his numerous works only the titles are now known.

Xenoph′anes, of Colophon, Greek philosopher, born about 570 B.C., for some time settled at Elea, and regarded as the founder of the Eleatic school of philosophy (q.v.). He died about 480 B.C.

Xen′ophon, Greek historian, general writer, soldier, and sportsman, was born about 430 B.C., and died probably soon after 355 B.C. He belonged to an aristocratic family of the deme of Erchia. While still a boy he became an enthusiastic follower of Socrates, though his temperament afterwards led him to adopt an active rather than a contemplative life. He fought at Arginusæ (406 B.C.), and was present at the trial of the generals and the overthrow of the Thirty. His political opinions rendered his continued residence at Athens unpleasant if not unsafe, and he was easily persuaded by his friend Proxenus to join, as a sort of free-lance, the army of Greek mercenaries led by the satrap Cyrus. This army was nominally taking the field against the Pisidians; actually it was going to attack Cyrus's brother, Artaxerxes Mnemon, the King of Persia. A battle was fought at Cunaxa (401), Cyrus was killed, and the principal Greek officers were treacherously murdered by the satrap Tissaphernes. An army of ten thousand men was thus left without leaders in the heart of an enemy's country, and more than a thousand miles from home. Xenophon assumed supreme command of the army, and conducted what is one of the most famous retreats in all military history. After more than five months of marching, fighting, and meeting with adventures of all kinds they reached Trapezus; at last Xenophon handed his army over to the Spartan Harmost Thibron in March, 399. Near Pergamum Xenophon captured a wealthy Persian nobleman, whose ransom secured him a moderate competency for life. The remainder of Xenophon's life was something of an anti-climax. He served under Agesilaus, King of Sparta, and was present (possibly as a non-combatant) at the battle of Coronea (394), when the Spartans defeated the Athenians and Thebans. For this he was banished by the Athenians, and given an estate at Scillus in Elis by the Spartans. Here he devoted himself to a life of hunting, spending his spare time in educating his two sons and writing his various books. After the battle of Leuctra (371) Xenophon was driven from his estate. His sentence of banishment from Athens was cancelled, but he never resided there again. He ended his days at Corinth.

It is probable that all Xenophon's works are still extant; this fact alone bears witness to the high esteem in which he was held as an author. The most important and popular of his writings is the *Anabasis*, an account of the expedition of Cyrus and the return march of the ten thousand. Xenophon has made one of the most romantic episodes in history into a plain unvarnished tale; his writing is all the more effective because he does not strive after effect. He probably published the book under the name of Themistogenes of Syracuse to avoid legal difficulties. In the *Memoirs of Socrates* he gives a good account of his old master from the ordinary man's point of view. As a complementary picture to that given by Plato this book is invaluable. A small pamphlet *On the Apology of Socrates* is probably not genuine, and is certainly not important. The *Symposium* (Supper-party) is a brilliant Socratic dialogue which gives much valuable antiquarian information. The *Œconomicus* gives a pleasant picture of a Greek wife and household. The *Hiero* is a debate upon absolute monarchy between Hiero and Simonides. The *Agesilaus* is an example of that unnatural and insipid production the panegyric. The first two books of the *Hellenica* are a continuation of Thucydides; books iii to vii give the history of the Spartan and Theban hegemonies down to the death of Epaminondas. The *Hellenica* is valuable as being the only contemporary account of events between 411 and 362 B.C., but it is obviously the work of an amateur in history. Xenophon's other works include: *On the Constitution of Lacedæmon* (the companion-piece *On the Constitution of Athens*, a most interesting work, is not by Xenophon, but probably owes its preservation to the fact that it was attributed to him), *On Athenian Finance, A Manual for a Cavalry Commander, A Manual of Horsemanship, How to Hunt with Hounds*, and the *Cyropædia*, a political and philosophical romance.

Xenophon writes in a conversational style, and he probably spoke 'plain soldier'. "What he hath seen and heard, that he testifieth"; when he is dealing with anything which is outside his personal experience, he is not master of his material. He was a religious, practical, and unimaginative man, with the outlook upon life of a heavy dragoon of the better sort. His works owe not a little of their value to the fact that, unlike most extant Greek authors, he was not a genius.—BIBLIOGRAPHY: A. Croiset, *Xénophon, son caractère et son talent*; Sir Alexander Grant, *Xenophon* (Ancient Classics for Modern Readers Series).

Xerophyte, a plant adapted to scanty water-supply. Externally, the adaptation usually takes the form of reduction of leaf-surface, for instance in succulents, switch-plants, and plants with rolled leaves. The anatomical features also are usually such as to keep down loss of water by transpiration, e.g. stout epidermis, few and deeply sunk stomata, hairy or wax-coated shoots, &c. Storage of water is likewise often in evidence, especially among succulents. Xerophytes are naturally most prevalent in dry districts, but also occur wherever local conditions tend to accelerate transpiration or to interfere with absorption of water by the roots; hence arctic and alpine species, epiphytes, and plants inhabiting the seashore or the sour soils of heaths, moorlands and peat-bogs are all more or less xerophytic.

Xerxes I, King of Persia, famous for his unsuccessful attempt to conquer Greece, was the son of Darius and of Atossa, daughter of Cyrus. He began to reign 485 B.C., and continued his father's preparations for another Persian invasion of Greece. The army which he collected must on the soberest estimate have exceeded a million of men, with a fleet of 1200 sail. Xerxes crossed the Hellespont (480 B.C.), and met with no resistance until he reached the Pass of Thermopylæ. After Leonidas had fallen there with his Spartans, Xerxes pressed forward and burned Athens, which had been forsaken by almost all its inhabitants. He watched from the mainland the naval battle of Salamis (Sept., 480 B.C.), and fled ignominiously after the overwhelming defeat of his fleet. Xerxes was assassinated 465 B.C.

Ximenes (*h*i-mā′nes), Francisco, Spanish cardinal, born in 1436, died in 1517. In 1492 he was appointed confessor to Queen Isabella of Castile, and in 1495 Archbishop of Toledo. In 1507 he was made a cardinal. In 1516 King Ferdinand died, leaving Ximenes regent during his grandson Charles's absence in the Netherlands. In 1517 Charles returned to Spain, and, prompted by jealousy of the power of Ximenes, dismissed him. Ximenes died almost immediately afterwards.

Xingu, a river of Brazil, a right-bank tributary of the Amazon, rises near lat. 15° S., long. 59° W., in the plateau of Matto Grosso, and after flowing north for 1300 miles joins the Amazon 240 miles west of Pará.

Xiphodon (zif′o-don), an Eocene genus of fossil mammals closely allied to Anoplotherium.

X-Ray Spectra. The more important facts relating to these are given in the articles *Rays, Electric*; *Spectra, Theory of*; *Number, Atomic*; *Matter*. In the X-ray spectrometer, the instrument used by Sir W. H. and W. L. Bragg in their researches on the structure of crystals, the rays pass through slits in two lead screens, and strike very obliquely the face of an analysing crystal mounted on a goniometer. The reflected rays enter an ionization chamber connected to an electroscope, and the readings of the electroscope are plotted against the angles of incidence of the rays on the face of the crystal. The crystal acts as a sort of diffraction grating in three dimensions. If incident radiation of wavelength λ makes an angle θ with a face, which may be regarded as one of a set of parallel planes, in which the particles of the crystal can be arranged, then the radiation is partially reflected at each plane of the set. The different reflected waves will in general be out of phase with each other, in which case their resultant effect will be imperceptible. If, however, $2d \sin\theta = \lambda$ or 2λ or 3λ, &c., where d is the distance between two consecutive parallel planes, then it is easily seen from a figure that the reflected waves are in phase, so that the intensity of the reflected beam has a maximum value. The graph therefore determines the ratio λ/d. If d is known for any one crystal, λ can thus be found for any homogeneous radiation, or d for any other crystal. The value of the 'lattice-constant' d for rock-salt has been calculated by Sir William Bragg to be $2{\cdot}81 \times 10^{-8}$ cm. More recently, methods have been devised which do not require the crystal to be of large size, and which can even be applied to crystalline material in the form of a fine powder.

Xylaria, a genus of ascomycetous Fungi, group Pyrenomycetes. The black, antler-shaped fructifications of *X. polymorpha* are plentiful on rotting tree-stumps and logs.

Xylem, the woody or water-conducting part of the vascular tissue of plants. Its most important constituents are tracheæ or wood-vessels and tracheids. See *Vascular Tissues.*

Y

Y, the twenty-fifth letter of the English alphabet, was taken from the Latin, the Latin having borrowed it from the Greek Υ or upsilon. In modern English it is both a consonant and a vowel. At the beginning of syllables and followed by a vowel it is a consonant; in the middle and at the end of words it is a vowel.

Yacht and Yachting. A yacht is a decked vessel, provided with either sails or steam as motive power, and used exclusively for pleasure-cruising or for the sport of yacht-racing. The term will thus include alike the two- or three-ton yawl or cutter and the floating palace of a prince or millionaire, as large as an Atlantic liner, capable of cruising in all weathers and in any sea. Our English monarchs had their yachts in very early days; but the name was first used in 1660, when Charles II received the gift of a Dutch 'jacht', the *Mary*. A hundred years before, Elizabeth had a yacht built for her at Cowes, now the southern head-quarters of British yacht-racing, as the Clyde is the great Scottish centre of the sport. Yachting has been popular in this country for two centuries, the Water Club of Cork dating from 1720, and a great impetus being given by the foundation of the Royal Yacht Squadron in 1812. Thirty years later the United States entered with enthusiasm into the amusement, and in 1851 the trans-Atlantic yacht *America* was successful at Cowes in securing the cup of the Royal Yacht Club. This the United States still holds, in spite of the efforts to recover it made by Sir Thomas Lipton with several successive *Shamrocks.* The type of yacht employed for racing has been modified considerably since 1897. Under the tonnage rule, until that date, breadth of beam was heavily handicapped, while no measurement of sail area was taken. A large sail area, with a counterbalancing heavy keel, was consequently popular. The new rule took into consideration only length and sail measurement, and yachts at once became much broader, with but small displacement, and great overhang both fore and aft. A later rule was introduced to tax any hollowness in profile. Yacht-cruising, apart from racing, as practised in and around almost every English harbour, is not only a healthy and delightful pastime, but a most valuable training-school for the navy and merchant service.—BIBLIOGRAPHY: A. H. Clark, *History of Yachting*; J. Denholm-Young, *Reed's Yacht Management*; Dixon Kemp, *Manual of Yacht and Boat Sailing.*

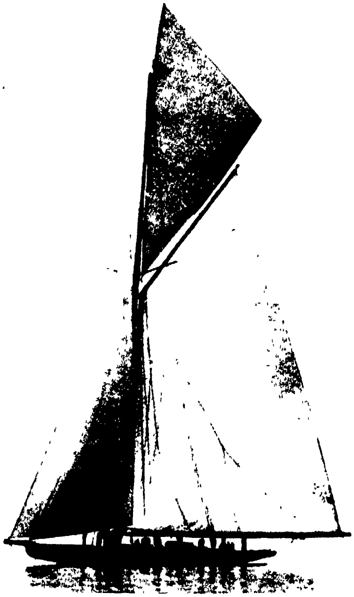
Yak, the *Bos grunniens*, a fine large species of ox, with cylindrical horns, curving outward, long pendent silky hair fringing its sides, a bushy mane of fine hair, and long silky tail; inhabiting, both in the wild and the domesticated state, Tibet and the higher plateaus of the Himálayas; called *grunniens* (grunting) from its very peculiar voice, which sounds much like the grunt of a pig. It is the ordinary domestic animal of the inhabitants of those regions, supplying milk, food, and raiment, as well as being used as a beast of burden and to draw the plough.

Yakima, a city of Washington, United States, the county seat of Yakima county; served by the Northern Pacific and other railways. It is an agricultural centre. Pop. 18,600.

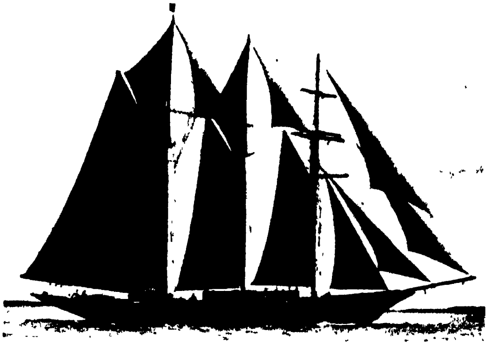
Yakuts, a nomadic people forming a division of the Siberian Turko branch of the Turanian family of peoples. About a quarter of a million in number, they occupy mainly the valley of the Lower Lena, in North-Eastern Siberia, and are engaged in horse- and cattle-raising. They are ostensibly Christians, but Shamanism prevails, although they are culturally among the most advanced of all the Siberian tribes. Their language is an archaic Turkish dialect. See map under *Turanian.*

Yakutsk, a territory of Eastern Siberia, comprising almost the whole of the basin of the River Lena; area, 1,530,253 sq. miles. From the afforested Vitim Plateau (average, 3000 feet altitude) the country descends through a submontane region to the tundras and the Arctic Ocean, in which the De Long, New Siberian, and Lyakov island-groups belong to the territory. The Lena is the

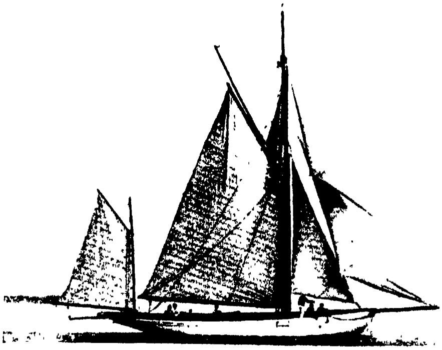
YACHTS



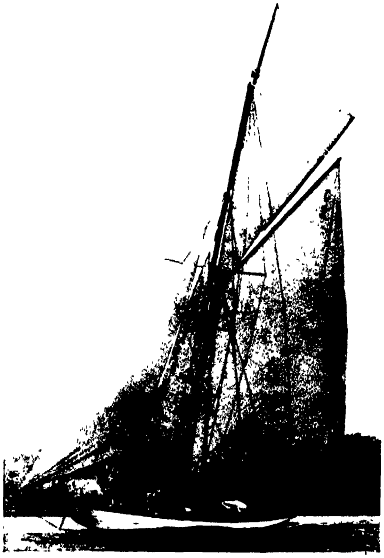
Cutter *Shamrock IV*



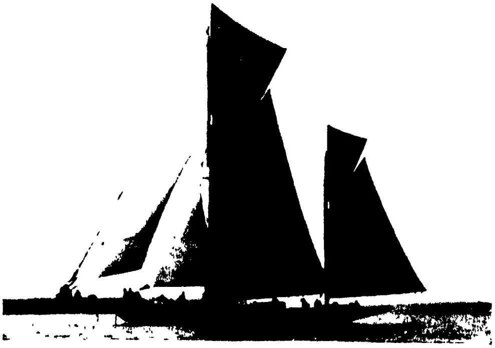
Three-masted Topsail Schooner *La Cigale*



Pole-masted Yawl *Hawk*



Pole-masted Cutter *Octavia*



Ketch *Valdora*

chief channel of communication, and the river-fisheries as well as those of the Kolyma Bay zone (herring, sturgeon, crucian carp, bass, sterlet, and burbot) are noteworthy. Alluvial gold (around Olekminsk), furs, and salt are the chief products; many reindeer and sledge-dogs are bred. The Yakuts (q.v.) are the chief people. Yakutsk is the capital (altitude, 300 feet; mean annual temperature, 12° F.: January, 46°; July, 66°, with absolute minima of −84° and 102° F. respectively: rainfall, 13·5 inches; August, 2·6 inches; February, 0·2 inches: pop. 12,000). There are iron deposits round the capital. Verkhoyansk (q.v.) is in the territory.

Yale University, one of the oldest and largest of American universities, originally a collegiate school established at Saybrook, Connecticut, in 1701. It was removed in 1716 to New Haven, and soon after its name was changed to Yale College, after Elihu Yale (1649–1721), an early benefactor of the institution. The aggregate number of volumes in all the libraries of the university is over 1,000,000, of which 1000 were presented in 1730 by Bishop Berkeley. Its buildings are now very extensive, and its funds have greatly increased by private munificence. The teaching staff numbered (1921–2) 753, and the total number of students was over 3900.

Yalta, a seaport-town and watering-place of Ukraine, on the Sea of Azov. The climate is temperate (mean annual, 62·5° F.; January, 38°; August, 86·4°). Pop. 12,000 (but much larger in season).

Yalu River, a river of Eastern Asia, rising in the Chang-pai-shan, and flowing south-west to West Chosen (Korea) Bay; length, 300 miles. It forms the boundary between the Chinese province of Fengtien and Korea (Chosen). On 17th Dec., 1894, the Japanese defeated the Chinese fleet off the mouth of the Yalu, and in April, 1904, the Japanese gained a decisive victory over the Russians by forcing the passage of the Yalu.

Yam, a large esculent tuber or root produced by various plants of the genus Dioscorea, order Dioscoreaceæ, growing in the warmer regions of both hemispheres. Yams, when roasted or boiled, form a wholesome, palatable, and nutritious food, and are extensively cultivated in many tropical and sub-tropical countries. The Chinese or Japanese yam (*D. Batātas*) contains more nitrogenous and therefore nutritive matter, but less starch, than potatoes. It is hardy in Great Britain and thrives in the United States. The tubers of *D. alāta*, the West Indian yam, one of the species most widely diffused, sometimes attain a weight of 50 lb.

Yamagata, Aritomo, Prince, Japanese field-marshal and statesman, born 1838, died 1st Feb., 1922. He rose from a position of insignificance to one of great political power, became Minister of War in 1870, and was Prime Minister in 1889, and again in 1898. In the Chino-Japanese War (1894–5) he commanded the First Army, and was Chief of Staff during the Russo-Japanese War. He received the O.M. (British) in 1906, and was made a prince in 1907.

Yang-tze-kiang, one of the two great rivers of China, is formed by two streams rising in Eastern Tibet, in 26° 30′ N. lat., 102° E. long., and after flowing east and then south enters the Chinese province of Yunnan. Pursuing a very tortuous course, much of it through most fertile and densely populated regions, it reaches the great city of Nanking, 200 miles from the sea, where it widens gradually into the vast estuary which connects it with the Yellow Sea. Its whole course, under various names, is 2900 miles, and the area of its basin is computed to be 548,000 sq. miles. It is connected by the Grand Canal with the Hoang-ho or Yellow River, and is navigable for vessels of considerable draught for 1200 miles from its mouth. By the Treaty of Tien-tsin the Lower Yang-tze was opened to European trade; and 700 miles from its mouth is the treaty-port of Hankow, the great commercial port of Mid-China. The highest port on the river at present reached by steamers is Ichang, 1000 miles from its mouth.

Yankee, the slang or colloquial name for Americans belonging to the New England states. During the American Revolution the name was applied by the British to all the insurgents; and during the Civil War it was the common designation of the Federal soldiers by the Confederates. In Britain the term is sometimes improperly applied generally to natives of the United States. The most common explanation of the term seems also the most plausible, namely, that it is a corrupt pronunciation of *English* or of French *Anglais* formerly current among the American Indians. It has also been suggested that it is formed from the Dutch *Jan Kes*, i.e. John Cornelius, both of which names are used as nicknames in Dutch.

Yap, an island-group of the Caroline Islands, a German possession until 1914, now under Japanese mandate. It is volcanic and coral-fringed, and produces coco-nuts. Copra and pearl-shell are exported, but the island is mainly of importance as the nerve centre of submarine-telegraphic communications in the West Pacific, being the landing-place of cables to Madang (Papua), Menado (Celebes), Shanghai, and Manila (by way of Guam). On this account the Japanese possession was disputed by the United States after the European War, and their differences were only settled by the Washington Conference. Area, 95 sq. miles; pop. 7000.

Yaracuy, a state of Venezuela with a seaboard on the Golfo Triste. It is well-wooded, mainly flat, traversed by the Yaracuy River, and rich agriculturally, producing coffee, cacao, tobacco, sugar, and indigo. Towns are San Felipe (pop. 15,500; on a branch of the Tucacas-Barquisimeto railway), the capital, and Yaritagua (pop. 5000). State pop. 108,000.

Yard, a standard measure of length, equal to 3 feet or 36 inches. In Britain the yard is legally defined to be the distance at 62° F. between two lines on two gold plugs in a certain bronze bar. As a cloth measure the yard is divided into 4 quarters = 16 nails.

Yare, a river of Norfolk, England. See *Norfolk.*

Yarkand′, the chief town of the principal oasis of Chinese Turkestan, on the River Yarkand Darya. Pop. 100,000 to 200,000.—The river rises in the Karakorum Mountains, and helps to form the River Tarim, which traverses central East Turkestan, and enters Lob Nor after a course of about 1000 miles.

Yarmouth, or **Great Yarmouth**, a seaport, fishing-station, watering-place, and county borough of Norfolk, England. It is situated on a long and narrow tongue of land running from north to southward between the North Sea and the estuary of the Yare, and is connected by a bridge with Little Yarmouth, or South Town, in Suffolk. There are extensive sands and esplanades with two piers. Parallel with the north and south quays, extending for nearly a mile and a quarter, are the principal streets, crossed by numerous narrow lanes called ‘ rows ’. The parish church of St. Nicholas was founded in 1101. Yarmouth is the great seat of the English herring- and mackerel-fishery, and also furnishes large quantities of white-fish. The curing of herring as ‘ Yarmouth bloaters ’ is an important industry. During the European War, Yarmouth was bombarded by German battle-cruisers and torpedo-boat destroyers (3rd Nov., 1914; 25th April, 1916; and 14th Jan., 1918). Pop. (1921), 60,710.

Yarmouth, a seaport-town in the south of Nova Scotia, the chief shipbuilding place in the province, and a noted summer-resort. It has important lumber exports. Pop. 7500.

Yarra-Yarra, the Australian river on which Melbourne, Victoria, is situated. Its length is about 100 miles. On account of falls it is not navigable above Melbourne.

Yarrow, a parish of Selkirkshire, Scotland. The River Yarrow, famous in song, issues from the foot of St. Mary's Loch, and flowing 14½ miles eastward falls into the Ettrick, 2 miles south-west of Selkirk.

Yaws, or **Frambœsia**, is a chronic infectious disease prevalent in the tropics. In its course it resembles syphilis, and at one time it was believed to be a variety of that disease, but recent research has shown that it is caused by a distinct, though somewhat similar, organism. The incubation period varies from a fortnight to six months, and is characterized by slight fever, joint pains, and digestive disturbance. Ulcerations then appear on the face or limbs, known as the primary stage, to be followed several months later by the secondary stage, a scaly eruption, which may affect the whole skin, but is usually more marked on the lips, nostrils, genital region, and the flexures of the limbs. Treatment consists of the free use of mercury and potassium iodide, while lately salvarsan (606) has been used with success.

Year, the period of time during which the earth makes one complete revolution in its orbit. Its mean length is 365 days, 5 hours, 48 minutes, and 46 seconds. In popular usage, however, the year consists of 365 days, and every fourth year of 366.—*Anomalistic year.* See under *Anomaly.* —*Civil year*, the ordinary year of 365 days.—*Ecclesiastical year*, from Advent to Advent. —*Gregorian year*, *Julian year*. See *Calendar.*—*Lunar year*, a period consisting of 12 lunar months. The *lunar astronomical year* consists of 12 lunar synodical months, or 354 days, 8 hours, 48 minutes, 34 seconds. The *common lunar year* consists of 12 lunar civil months, or 354 days. The *embolismic* or *intercalary lunar year* consists of 13 lunar civil months, and contains 384 days. The Mahommedans and Jews use a lunar year.

Yeast. See *Fermentation.*

Yeats, William Butler, Irish poet and dramatist, born 1865. He has written poems, lyrical dramas, prose tales and sketches, and plays for the Irish theatre. His works include: *The Land of Heart's Desire* (1894); *The Secret Rose* (1897); *The Shadowy Waters* (1900); *Cathleen ni Hoolihan* (1902); *The Hour Glass* (1903); *The Cutting of an Agate*, a volume of essays (1919); *Reveries* (1916); and *Michael Robartes and the Dancer* (1921). He was awarded the Nobel Prize for Literature in 1923.

Yell, the second largest of the Shetland Islands, separated from the Mainland by Yell Sound, and 25 miles north of Lerwick. It is about 17½ miles in length, and from half a mile to 6 miles in breadth. The surface is chiefly moorland, and fishing is the leading employment. Pop. 2300.

Yellow. See *Colour*; *Paints and Pigments*; *Spectrum.*

Yellow-bird, a small singing bird common in the United States, the *Carduelis tristis*, also known as the American siskin. In summer the male is of a lemon-yellow, with the wings, tail, and fore part of the head black.

Yellow Fever, a specific fever arising from the bite of an infected mosquito (q.v.). It is endemic in the West Indies, on the coasts of Central and South America, and on the west coast of Africa, and is spread by shipping to other regions, where, however, it never takes a firm hold. The onset is sudden, with rigor, headache, and pains in the back and limbs, while a jaundiced appearance is noted early, and to this its name is due. These symptoms are followed in four or five days by vomiting; the vomit is black, due to the presence of blood, hæmorrhages from various parts of the body, scanty urine, and definite jaundice. The patient becomes very weak and prostrated, and death frequently occurs. The mortality varies from 30 to 80 per cent. The measures adopted against the mosquito Stegomyia are rapidly bringing the disease under control, and in 1922 Central America, the West Indies, and all but one country of South America were free from yellow fever, which had ravaged these regions for nearly two hundred years.

Yellow-hammer, a small perching bird of the genus Emberiza, the *E. citrinella*; called also *yellow-bunting*. It belongs to the finch family. The head, cheeks, front of the neck, belly, and lower tail-coverts are of a bright-yellow; the upper surface is partly yellow, but chiefly brown, the feathers on the top of the back being blackish in the middle, and the tail feathers are also blackish. The yellow-hammer is a resident in Britain, and generally throughout Europe.

Yellow Sea (Chin. *Hoang-hai*), an arm of the Pacific Ocean, on the north-east coast of China. It is very shallow, and its name refers to the lemon-yellow colour of its water near the land, caused by mud suspended in the water from the inflow of the Rivers Hoang-ho and Yang-tze-kiang.

Yellowstone National Park, a region mainly in Wyoming, United States, which in 1872 was withdrawn from settlement by the United States Government to become a park or tract for the recreation of the people. Its area is 3350 sq. miles, besides a forest area of 2000 sq. miles reserved since 1891. Its surface is mainly an undulating plain, diversified, however, by mountain ranges, one of which, the Absaroka, a range separating the waters of the Yellowstone River from those of the Big Horn, contains some of the grandest scenery in the United States. The whole region exhibits an endless variety of wild volcanic scenery—hot springs, mud volcanoes, geysers, cañons, waterfalls, &c. The geysers are more remarkable than those of Iceland, and are gathered together in the upper course of the Madison River, called at this point the Firehole. Yellowstone Lake, one of many, has an area of 150 sq. miles. A large part of the park is covered with forest. Stringent legislation protects the game, with the result that elk, deer, antelope, bear, and bison have taken refuge in it.

Yellowstone River, a river of the United States, which rises in the Rocky Mountains, about lat. 44° N. and long. 110° W. It passes through the lake of the same name, and runs northward through the Yellowstone National Park, the eastern portion of which belongs to its drainage basin. Soon after issuing from the lake, the river makes at intervals a series of falls (Lower Fall being 308 feet high), and traverses cañons, one of which, the Grand Cañon, is 25 miles in length. The river ultimately joins the Missouri about lat. 48° N., after a course of some 1100 miles.

Yellow-throat, a small North American singing bird (*Trichas marylandica*) of the warbler kind, and included in the thrush family.

Yemen, an imamate of Arabia, occupying the south-west angle of the peninsula. Amongst its principal products is coffee, to a specially prized kind of which Mocha, one of its seaports, has given name; but the coffee export has declined and given place to hides. Estimated area, 73,800 sq. miles; pop. about 750,000. The chief potentate is the Imâm of Sana'a, lineal descendant of Fatima, the Prophet's daughter. Sana'a (pop. 25,000) is the capital and Hodeida (pop. 50,000) the chief port.

Yenisei, a river of Asia, rising in Mongolia, and flowing northward through Siberia to the Arctic Ocean. Length, 3000 miles.

Yeniseisk, a province of Eastern Siberia, extending from the Chinese frontier to the Arctic Ocean. The Minusinsk district is the provincial granary, and also produces gold, antimony, coal, asbestos, copper, and Glauber's salt. Graphite (near Turukhansk), iron, mica (Krasnoyarsk district), platinum, salt (Abakansk), radium (in the Ayakhta Valley), and marble are other products. Apiculture is highly developed in Achinsk and Minusinsk districts, and sturgeon and sterlet are caught in the Lower Yenesei; and the north is a vast fur-bearing region. Area, 981,607 sq. miles; pop. 1,143,900.

Yeniseisk, the capital-town of Yeniseisk, Siberia, on the Yenisei some 1520 miles from its mouth, and at the head of navigation for small sea-going steamers. The passage is open from June to November. The mean annual temperature is 28° F. (January, —10·1° F.; July, 66·9° F.); precipitation, 17 inches. Pop. 73,500.

Yeomanry, or volunteer cavalry regiments, were first raised in the last decade of the eighteenth century. At this time there was a considerable danger of a French invasion, and the English Government was hard-pressed for troops. William Pitt was Prime Minister, and caused an Act to be passed authorizing the compulsory raising of certain troops, among them being some regiments of 'provisional cavalry'. According to Fortescue, this was done in a half-hearted way for fear of causing discontent from the use of these compulsory powers, and shortly after the passing of the Act it was amended to allow of voluntary enlistment instead. The regiments so raised were known as Volunteer Cavalry or Yeomanry. In 1804 an Act was passed amending all former Acts dealing with this force, and yeomanry were made liable in case of invasion to serve in any part of Great Britain. In 1907 yeomanry, in common with the other auxiliary troops, came under the operation of the Territorial and Reserve Forces Act of that year, and were merged in the Territorial Force. At the beginning of 1922 the Army List showed fifty-five regiments of yeomanry as being in existence, but many of these are being converted into other arms, and some have been disbanded. All those which remain, whether as cavalry, artillery, or armoured-car units, will form part of the Territorial Army, and will be administered in common with all other Territorial units by the county associations.

Yeovil (yō′vil), a municipal borough of Somersetshire, England, on the River Yeo or Ivel. It is noted for its manufacture of gloves. Pop. (1921), 14,987.

Yew, an evergreen tree of the genus Taxus, nat. ord. Taxaceæ. The common yew is *T. baccāta*, indigenous in most parts of Europe, and found in many parts of Great Britain and Ireland. It is a handsome tree, growing to a height of from 30 to 40 feet, with numerous spreading branches, forming a dense head of foliage. Its trunk is thick, and has been known to attain a circumference of 56 feet. Its fruit is a red berry with green seeds. It used to be frequently planted in churchyards, and its tough elastic wood was extensively used in the manufacture of bows.

Yezd, a city of Persia, in an oasis in a sandy plain 190 miles south-east of Ispahan. It is noted for its velvet and other silk manufactures, and has a Zoroastrian community. Pop. about 45,000.

Yezo, or, officially, **Hokkaido,** the most northerly of the larger Japanese islands. It has an area of 30,340 sq. miles, or, with thirteen adjacent dependent islands, 30,502 sq. miles, and forms 11·6 per cent of the total area of the Japanese Empire proper. The island is mountainous and volcanic, and is rich in minerals, including coal, gold, and silver. Towns include Sapporo, the capital (pop. 102,600), Hakodate (144,750), and Otaru (108,000). Near Hakodate there are thermal springs.

Yiddish (Ger. *Jüdisch*), the name applied to the Judeo-German dialect spoken in Russia, Poland, and America. Previous to the fourteenth century the Jews living in Germany spoke the dialects of the people among whom they dwelt. When, in consequence of the persecutions, they migrated eastwards, settling in Bohemia, Poland, and Lithuania, they took with them their mother-tongue. Separated, however, from the mother-country, the vocabulary, instead of following the same development as the German language, was increased by a number of Hebrew and foreign words. For various reasons, mostly religious and political, the dialect continued to be spoken by the Jews in the East, and a very considerable Yiddish literature, both in prose and poetry, now exists.—Cf. L. Wiener, *The History of Yiddish Literature in the Nineteenth Century.*

Yoghurt, a nutritious and refreshing type of fermented milk, very popular in Bulgaria, and often called Bulgarian sour milk. It is produced from the milk of the goat, buffalo, or cow by the inoculation of pasteurized milk with a certain bacterium. Kumiss (Russian steppes), Kefir (Caucasus), and Leban (Egypt) are similar products, which contain acid and small amounts of alcohol. Kumiss is made from mare's milk, the others usually from cow's milk.

Yokoha′ma, a city of Japan, the chief seaport of the empire, in the Island of Honshu, and on the west coast of Tokyo Bay. It is a modern city (see *Kanagawa*), and is connected with Tokyo by the oldest Japanese railway (1872). Silk is the chief export, and metals, woollens, and cottons the chief imports. During the terrible earthquake of 1st Sept., 1923, the city was partly destroyed. Pop. 422,900.

Yonkers, a city of New York, United States, in Winchester county, a suburb of New York City, on Hudson River; served by three divisions of the New York Central & Hudson River Railway. It is largely residential, but has also important manufactures. It became a city in 1872. Pop. 100,200.

Yonne, a department of Central France, traversed by the River Yonne, which is navigable throughout it. The granite mountains in the south-east attain a height of 2000 feet. Large wheat and oat crops are raised, and the vines yield the finest red wines of Lower Burgundy, and the finest of white wines, the well-known Chablis. Horses are raised around Charny. Auxerre is the capital; Villeneuve (sur-Yonne), Joigny, Sens, Avallon, St. Florentin, and Tonnerre are other places. Area, 2892 sq. miles; pop. (1921), 273,118.

York, a cathedral city and archiepiscopal see of Yorkshire, England, the county town, on the Ouse where it is joined by the Foss. Said to have been founded in 983 B.C., York was a town of the Brigantes, but it first leaps into fame as *Eboracum* (*Eburacum*), the chief town of Roman Britain. After the Roman retirement, the place became a Danish borough as *Jordvik*, and to this period belongs the foundation of the archiepiscopal see (627) by Edwin of Northumbria, Paulinus being the first archbishop. The first charter dates from the reign of Henry II. Dwarfing all other civic buildings in point of interest is the Minster, one of the most majestic of British cathedrals, which inherits a rich tradition dating back to the little wooden building of A.D. 627, out of which, and through edifices of the eighth, ninth, eleventh, twelfth, and thirteenth centuries, down to the reconstruction of 1472, the present magnificent pile has been evolved. The ruined Benedictine abbey of St. Mary's occupies the site of a Roman temple, and of a priory of St. Olave, founded 1078. St. Peter's grammar-school (1557) and that of Archbishop Holgate (1546) are worthy of note. Pop. (1921), 84,052.

York, a city of Pennsylvania, United States, the county seat of York county; served by the Maryland & Pennsylvania, and other railways. It is an agricultural centre with foundry products. Founded in 1741, it became a city in 1887. Pop. 47,500.

York, a city of Maine, United States, in York county, on the Atlantic; the terminus of a division of the Boston & Maine Railway. It is a prominent summer-resort. Pop. 9000.

York, a city of Nebraska, United States, the county seat of York county; served by the Chicago & North-Western Railway. It is an agricultural centre. Founded in 1864, it became a city in 1877. Pop. 9000.

Yorkshire, the largest county of England.

	Acreage.	Sq. Miles (approx.).	Population (1921).
County-city ..	3,730	6	84,052
West Riding ..	1,773,529	2,771	3,181,654
North Riding ..	1,362,058	2,128	456,312
East Riding ..	750,115	1,172	460,717
Total	**3,889,432**	**6,077**	**4,182,735**

The main portion of this county forms a large central valley stretching south-east to the Humber, flanked on one side by the Pennine range and on the other by the Cleveland Hills, and drained by the Ouse and its tributaries. The North Riding includes the Vale of York and the Cleveland district, with its iron ore. Towns include York (the capital), Scarborough, and Middlesborough. In the East Riding industrial activity is centred in Hull. In the North and West Riding there is much mountain pastureland. The West Riding has long been famous for its woollen and worsted manufactures, of which it is now the chief seat. Their development has been aided by the proximity of coal and iron. The great coal-field of the West Riding, part of that of Central England, yields not only excellent house coal, but also coal admirably fitted for iron-smelting and for use in engine furnaces. Leeds produces every variety of woollen goods; Bradford, mixed worsted fabrics and yarns; Dewsbury, Batley, and adjoining districts, shoddy; Huddersfield, plain goods, with fancy trouserings and coatings; and Halifax, worsted and carpets. Barnsley is famous for its linen manufactures, of which Leeds also is a seat, as well as of that of leather. Next to the woollen and other textile industries comes the manufacture of iron and steel machinery, and implements of every description. Leeds is one of the principal seats of all kinds of mechanical engineering, and Sheffield of iron-work and cutlery.

Yorktown, a city of Virginia, United States, the county seat of York county, on York River; served by the Chesapeake and Ohio Railways. It is noted as the place where Cornwallis surrendered to Washington (19th Oct., 1781).

Yor'uba, a country of West Africa, attached to the colony and protectorate of Lagos. Area, 28,000 sq. miles; pop. 2,000,000. The Yorubas are a negro people, and have a tribal organization. Among their large cities are Oyo, Ilorin (q.v.), Ibadan (q.v.), and Abbeokuta (q.v.).

Yosemite Valley, one of the greatest natural wonders of North America, in Mariposa county, California, about 140 miles south-east of San Francisco and midway between the eastern and western bases of the Sierra Nevada. It is a narrow valley at an elevation of 4000 feet above the sea, and is itself nearly level, about 6 miles in length, and varying in width from ½ mile to 1 mile. On each side rise enormous domes and almost vertical cliffs of granite, the Half Dome being 4737 feet higher than the River Merced at its base. The valley forms part of Yosemite National Park (1500 sq. miles).

Youghal (yạl), a seaport-town of Cork, Ireland, on the Blackwater estuary; a centre for monthly cattle fairs. Exports include bricks, earthenware, and corn. There is a salmon-fishery in the Blackwater. Founded by the Vikings in the ninth century, it received a charter from King John (1209), and was Cromwell's headquarters in 1649. Myrtle Grove was the mansion of Sir Walter Raleigh, who was Mayor of Youghal in the year 1588-9. Pop. 6100.

Young, Arthur, British agricultural writer, born 1741, died 1820. Of his many writings his *Travels in France*, published in 1792, is the most interesting, from its sketches of the social as well as the agricultural condition of the French provinces just before and just after the Revolution of 1789.

Young, Brigham, president of the Mormon Church, born 1801, died 1877. He was one of the twelve founders of Nauvoo, and after the murder of the prophet, Joseph Smith, and the flight of the Mormons from Nauvoo, Young became their leader. He was elected their president on their settling in Utah, and when this was made a territory he was appointed its Governor by President Polk. In 1852 he announced that polygamy had been commanded in a special revelation to Joseph Smith, and it was accepted generally by the Mormons of Utah. Young was a man of great practical ability. Utah flourished under his rule, and he long withstood successfully the efforts of the United States Government to establish its authority there.

Young, Edward, English poet, author of *Night Thoughts*, was born in 1683, and died in 1765. His father was rector of Upham, and subsequently Dean of Salisbury. Young was educated at Winchester College, of which his father was a Fellow, and at Oxford. He matriculated at New College, migrated to Corpus, and finally became a Fellow of All Souls. He graduated B.C.L. in 1714 and D.C.L. in 1719. According to Sir Herbert Croft, " There are those who related that when first Young found himself independent . . . he was not the ornament to religion and morality which he afterwards became ". According to Pope, Young passed " a foolish youth, the sport of peers and poets: but his having a very good heart enabled him to support the clerical character when he assumed it, first with decency, and afterwards with honour ". He was certainly a friend of Bubb Dodington and of the infamous Duke of Wharton; it is unlikely that their evil communications entirely failed to corrupt him. He excelled at writing fulsome dedications, and seems to have thought that flattery was the ' Open Sesame ' to worldly prosperity. He was doomed to be a disappointed man, and never attained the success as a layman or the preferment as a clergyman to which he believed himself to be entitled. Young began his career as a poet by writing addresses and odes of various kinds; one on the death of Queen Anne was, like Janus, two-faced, as it welcomed the coming and sped the parting monarch with equal enthusiasm. *Busiris*, a tragedy, was produced at Drury Lane in 1719; its chief title to fame is that it was ridiculed by Fielding. *The Revenge* appeared at the same theatre in 1721. In 1725 Young began to publish a series of satires, *The Universal Passion*, collected in 1728. These satires brought £3000 to their author, and contain many quotable lines; but, as Swift said of them, " they should either have been more angry or more merry ". *Ocean* and other odes appeared about 1728; some of these poems might well find a place in an anthology of humorous verse. Young ' assumed the clerical character ' some time before 1728, when he became chaplain to George II. He married a daughter of the Earl of Lichfield in 1731; the death of his wife, in 1741, inspired him to write his masterpiece, *The Complaint, or Night Thoughts on Life, Death, and Immortality* (1742–4). This poem was immensely famous in its day, was translated into French, German, Italian, Spanish, Portuguese, Swedish, and Magyar, and even still is not without readers. It is a portentous monologue, containing much commonplace thought and many lines which have become proverbial. It was mainly on the strength of this poem that German criticism set Young above Milton. Young's other works include a third play, *The Brothers* (1753), and *Resignation* (1762). In 1761 he was made clerk of the closet to the princess-dowager.

The great reputation of Young has almost entirely disappeared, but it is not inexplicable like that of Tupper and other writers who have now fallen on evil days. As Johnson says, " with all his defects, he was a man of genius and a poet "; and almost all his works contain oases of good writing amid a somewhat barren wilderness. He was not a good artist or a good self-critic. Many of his lines, however, have outlived his reputation, such as

> Procrastination is the thief of time;

> A fool at forty is a fool indeed;

and

> All men think all men mortal but themselves.

—Bibliography: W. Thomas, *Le Poète Edward Young*; George Eliot, *Essays and Leaves from a Notebook*; Samuel Johnson, *Lives of the Poets*.

Young, James, British chemist, was born at Glasgow in 1811, and died in 1883. He discovered a method of distilling oil from shale, and thus became the founder of the mineral-oil industry of Scotland.

Young, Thomas, British scientist, born in 1773, died in 1829. He qualified himself for the medical profession, and made some useful contributions to medical science. In 1802 he became the colleague of Davy as professor of natural philosophy at the Royal Institution, having previously made the discovery of the interference of light, the result of researches which, completed by Fresnel, secured the triumph of the undulatory theory. In 1807 appeared his admirable *Lectures on Natural Philosophy*.

Young Men's Christian Association, an organization founded in London on 6th June, 1844, by George Williams. Twenty years earlier David Nasmith started a ' Young Men's Society for Religious Improvement ' in Glasgow, now merged with the Glasgow Y.M.C.A. The world-wide organization of to-day, however, grew out of the Society formed in London by George Williams among his fellow-workers. The movement spread rapidly, and in 1855 the first International Conference was held in Paris, when ninety-eight delegates attended from seven countries. At this meeting a Basis of Union was adopted affirming that members be " Young men who, regarding the Lord Jesus Christ as their God and Saviour, according to the Holy Scriptures, desire to be His Disciples in their doctrine and in their life, and to associate their efforts for the extension of His Kingdom among young men ". Young men desiring to join without accepting the Basis are enrolled as Associates. At the International Conference held in Edinburgh in 1913, over 500 representatives attended from thirty-two countries. The movement originated in a Bible class, and was designed to foster the spiritual life of its members. Gradually it began to make provision for a young man's leisure, and now institutes, forming social and religious centres, are to be found in most towns. In large cities, such as London, Glasgow, or Chicago, hostels and gymnasia are provided. International offices have been established in Geneva, the head-quarters of the World's Committee of Y.M.C.A.'s. The British head-quarters are at Tottenham Court Road, London. The greatest development of the movement has been in the United States and in the British colonies. In recent years rapid progress has been made in the Far East, particularly in China. In 1902 social tents were set up by the Y.M.C.A. in the Territorial training-camps. On the outbreak of the European War the British Government asked the Association to establish similar centres in the training-camps being formed for the army. Within ten days Sir Arthur Yapp, General Secretary of the English Council, and his staff had 200 centres in operation. The work extended rapidly. Y.M.C.A. huts were set up in France and Flanders, Salonika, Egypt, Palestine, Mesopotamia, and Russia. Provision was also made for work among the Indian troops, the Chinese Labour Corps in France, and the munition workers at home. Over one thousand million pieces of stationery were distributed free. Lectures, concerts, sports, and games were arranged, and in many cases free refreshments were provided near the front line for walking wounded. The Y.M.C.A. huts offered a common platform for ministers of all denominations, and it is generally acknowledged that the efforts of the Association were an important factor in maintaining the *moral* of the troops both in the home training-camps and in the base camps abroad. The Association is interdenominational.

The *Young Women's Christian Association* came into being in London about 1850. Lady Kinnaird and Miss Robarts were associated in its formation. Its aim is to win young women for the Kingdom of God, and to associate their efforts in Christian service. It renders valuable community work through its hostels and holiday homes. The Travellers Aid and Emigration Department does much effective work in assisting girls arriving as strangers in large cities and in meeting emigrants at overseas ports. During the European War huts and canteens were established for the women workers in France, and in the various home centres where women were employed in munition work.

Youngstown, a city of Ohio, United States, the county seat of Mahoning county, on Mahoning River; served by the Baltimore & Ohio, Erie, and other railroads. There are iron- and steel-works, blast-furnaces, &c. Founded in 1796, it became a city in 1867. Pop. 132,260.

Young Turks, a Turkish political movement of obscure origin, whose leaders planned the Revolution of 1908, restored to Turkey the Constitution granted in Dec., 1876, and ' suspended ' in Feb., 1878, deposed Sultan Abdul Hamid II and set up his brother Reshad (Mahommed V) in his place, and endeavoured by the modernization of government methods and the doctrine of liberty, equality, and fraternity to justify Turkey's place as a European Power, and to stabilize her position by the creation of an efficient army and navy. Among leaders of the movement were: Mahmud Shevkhet Pasha, Talaat Bey, Enver Bey, Ahmed Riza Bey, Niazi Bey, Dr. Nazim, Djemal Pasha, Djavid Bey, and Kiamil Pasha. Salonika was the original node of the movement, which was controlled by a ' Committee of Union and Progress '. See *Pan-Islamism*; *Pan-Turanianism*; *Turanian*; *Turkey*.

Ypres (ē′pėr; Flem. *Y′pern*; I′pern), a town of Belgium, in the province of West Flanders, 21 miles north-west of Lille. From it the linen called *diaper* (d'Ypres) took its name. Its chief manufacture is lace. Ypres is especially associated with the British army and Imperial forces of the European War, in the course of which it was practically destroyed. Relics of the great Cloth Hall and the Cathedral St. Martin are preserved as memorials of the war, but the town itself has been repeopled and rebuilt. Pop. about 15,000.

Ypsilanti, a Phanariot Greek family claiming to be descended from the Comneni. *Alexander*, born 1725, died 1805, hospodar of Wallachia from 1774 to 1798, was executed at Constantinople. *Constantine*, son of preceding, born 1760, died 1816, was hospodar of Wallachia and Moldavia from 1799 to 1805, when he was deposed and attempted the liberation of Greece. He was exiled, and died at Kiev. *Alexander*, son of preceding, born 1792, died 1828, entered the Russian army (1809) and distinguished himself during the Napoleonic campaigns (1812–4). President of a Greek political club, he headed an insurrection in the Danubian principalities during 1821, was defeated by the Turks at Dragashan, and fled to Austria, where he died. *Demetrius*, younger brother of preceding, born 1793, died 1832, joined the Greek forces in 1821 at the opening of the struggle for independence, and became

Greek commander-in-chief in 1828. In 1829 his successful campaign was brought to a close by the capitulation of Aslan Bey.

Ypsilanti, a city of Michigan, United States, the county seat of Washtenaw county, on Huron River; served by Michigan Central Railway. Founded in 1825 (the name honours Demetrius Ypsilanti), it became a city in 1858. Pop. 10,000.

Yser, a river of France and Belgium, rising in the department of Nord, and disemboguing into the North Sea below Nieuport (West Flanders) after a course of 55 miles. The battle of the Yser (European War) was fought between the 17th and 31st Oct., synchronously with the first phase of the first battle of Ypres, and resulted in the complete hold-up of Albrecht, Duke of Württemberg's rush to Calais. See *European War* (last three paragraphs of section *First Battle of Ypres*).

Yssel, or **Ijssel**, in the Netherlands, a canalized arm of the Rhine, which it leaves 2 miles above Arnhem, and flows across Gelderland and Overyssel to join the Zuider Zee below Kampen. At Doesburg it is joined by the Oude or Old Yssel, and the Arnhem-Doesburg section represents the Roman *Fossa Drusiana*, a canal built in 12 B.C. to connect the Old Yssel with the Rhine. The Netherlands Yssel is an arm of the Lek, traversing Utrecht and South Holland, and joining the Maas opposite Ysselmonde (pop. 8000).

Ystad, a Baltic seaport of Sweden, län of Malmöhus; served by rail to St. Olof (via Gärsnös) and Malmö (39 miles), and by steamships to Copenhagen, Stockholm, Lübeck, Hamburg, Ronne, &c. There is an iron-foundry and shipbuilding, and manufactures include matches, sugar, chicory, and tobacco. Eggs, grain, molasses, oil-cake, &c., are exported. Pop. 11,400.

Yttria (Y_2O_3), the oxide of the rare element yttrium. Yttria is a white basic powder which readily absorbs carbon dioxide from the atmosphere. It occurs associated with other rare earth oxides in minerals such as *samarskite*, *gadolinite*, *monazite*, &c.

Yttrium (chemical symbol, Y; atomic weight, 89·33), one of the rare earth elements. It is related in some of its chemical properties to the metal aluminium. It forms an oxide of formula (Y_2O_3) and a chloride (YCl_3). The element is obtained by electrolysis of the fused chloride. It is greyish in colour, easily oxidized, and decomposes hot water.

Yuan Shih-K'ai, first President of China, born 1859, died 1916. He became President in March, 1912, after making a tremendous effort to save the Manchu dynasty, and thereafter he applied his great qualities of statesmanship and organization to the foundation of a new dynasty in his own person. When his schemes were complete—his enthronement had been arranged for Feb., 1916—the Japanese Government interfered, and he died shortly afterwards, retaining the presidency to the last.

Yucatan', a peninsula forming the south-eastern extremity of Mexico. Before its conquest by the Spaniards it was the seat of a flourishing civilization (see *Uxmal*). In 1861 the peninsula, which since 1824 had formed one state in the Mexican Confederation, was divided into two, Yucatan and Campeachy.

Yucatan, the most easterly state of Mexico, in Yucatan Peninsula. Mainly flat but hilly south-centrally, it produces maize, cotton, sisal, tobacco, rice, pepper, and sugar-cane, and was formerly noted for timber. Progreso and Sisal are ports; towns include Mérida (q.v.), Valladolid, and Motul. Among railways are those connecting Mérida with Peto and Progreso. Area, 15,939 sq. miles; pop. 350,000.

Yucca, a genus of American plants, nat. ord. Liliaceæ. The species are handsome plants, with white odourless flowers.

Yugoslavia, the popular name for the triune kingdom of the Serbs, Croats, and Slovenes (*Kraljevina Srba Hrvata i Slovenaca*) or, abbreviated, S.H.S. The S.H.S. is built up round Serbia (q.v.), the nucleus and the dominant partner, and includes Montenegro, Bosnia, Herzegovina, Croatia, Slovenia, and Dalmatia, the total area being 95,630 sq. miles, and the pop. 12,200,000 (9½ millions being Slav). Belgrade is the capital; other towns dealt with separately are: Agram (*Zagreb*), Laibach (*Ljubljana*), Kraguyevatz, Nish, Novi-Bazar, Serajevo, and Uskub (*Skoplye*). Trieste (q.v.) is the natural outlet for a large part of Yugoslavia, but belongs to Italy; Fiume is the gateway to Croatia.

Constitution, &c.—Yugoslavia is a kingdom, described as 'a constitutional, democratic, and parliamentary monarchy under the Karageorgevitch dynasty'. The style of the sovereign is 'King of the Serbs, Croats, and Slovenes', and Alexander I (born 1889), the first ruler of 'aggrandized Serbia', as the state has been called, ascended the throne on 6th Nov., 1921. Montenegro, as a separate kingdom of which the deposed king was still alive, formed a special problem until the death of King Nicholas (1st March, 1921), when Montenegro became, once and for all, a partner in the new state. Two alphabets are recognized—the Cyrillic and the Latin. All religions are tolerated, although nearly 50 per cent of the population is Greek Orthodox. About 35 per cent is Roman Catholic, and about 6 per cent is Muslim. There is a Parliament or Skupshtina elected for four years on the basis of one Deputy to every 40,000 of population. A Cabinet is responsible to the king, who summons Parliament and dissolves it, and is Commander-in-Chief of the army, which has a peace strength of 127,000. Service is compulsory between the ages of twenty-one and forty-five years, although in time of emergency all males between eighteen and fifty years may be conscripted. In the Government primary schools education is free and compulsory. There are universities at Belgrade, Zagreb, and Ljubljana.

Production.—Although largely agricultural—Serbia is a land of peasant owners—there are large mineral resources in coal, gold, lead, silver, iron, copper, antimony, &c. Stock-raising is progressive, and cereals and wheat are produced in large quanties. Viticulture, sericulture, and the production of fruit are important, and some tobacco is raised. Beet-sugar is produced. The forestal resources, mainly in beech, oak, and fir, are very large. Flour-milling is the principal manufacturing industry. Yugoslavia has a free customs zone of 9½ sq. miles at Salonika.—BIBLIOGRAPHY: D. A. Wray, *The Geology and Mineral Resources of the Serb-Croat-Slovene State*; No. 14 in vol. ii, part 2, *Peace Handbooks* (H.M. Stationery Office).

Yukon, a large river of North America, rising in Canada about lat. 57° 45′ N., long. 130° 45′ W., pursues a generally westward course, of which the length is estimated at 2000 miles, the greater portion in Alaska, and enters the Pacific by several mouths. For great part of its course it is navigable by steamers. See *Alaska*, *Canada*, *Klondike*.

Yukon, a north-western territory of Canada, intersected by the upper course of the navigable Yukon, and served by rail to White Horse (pop. 1921, 331) from the port of Skagway, in Alaska. The territory is of importance for gold on the Klondike and elsewhere, and also as a producer of coal, silver, and copper. Furs are produced, and there are fisheries and lumbering. Dawson (pop. 1921, 975), at the junction of the Klondike with the Yukon, is the capital. The area is 207,076 sq. miles; pop. (1921), 4157. Yukon is governed by a Commissioner and an elected Legislative Council of three members.

Yunnan′, the most south-westerly province of China. It is rich in minerals, especially copper, lead, tin, and zinc. Yunnan-fu is the capital. Estimated area, 146,680 sq. miles; estimated pop. 8,500,000.

Yuriev, or **Yuryev**. See *Dorpat*.

Yverdon, or **Yverdun** (ancient **Eburodunum**), a town of Vaud, Switzerland, at the south-western end of Lake Neuchâtel, on the Thièle; served by the Lausanne-Neuchâtel railway, with a light branch to Ste Croix (pop. 7000), a noted watch-making centre. A mile from Yverdon is the sulphur spring of Bains d'Yverdon. Pestalozzi's educational institution occupied the château (founded 1135) between 1805 and 1825, and a memorial stands before it (see *Pestalozzi*). There are railway workshops, an iron-foundry, &c. Pop. 9000.

Yvetot, a town of France, in the department of Seine-Inférieure; on the railway Rouen-Havre. From the fifteenth to the middle of the sixteenth century the lords of Yvetot bore the title of *king*, and their lands were exempt from service to the French Crown; hence Béranger's song *Le Roi d'Yvetot*. Pop. 7126.

Z

Z, the last letter of the English alphabet, is a sibilant consonant, and is merely a vocal or sonant *S*, having precisely the same sound that *s* has in *wise*, *ease*, *please*, &c. (see *S*). The words in modern English which begin with *z* are all derived from other languages, mostly from the Greek. When not initial, however, we often find it representing an older *s* in genuine English words, as in *blaze*, *freeze*, *gaze*, *graze*, &c.

Zaandam, or **Saardam**, a town of Holland, in the province of North Holland, on the Zaan; the junction for Enkhuizen on the Amsterdam-Helder railway. Pop. 28,500.

Zaborze, a town of Upper Silesia, Germany, in the Silesian coal-field. It has coking, electric, and other industries. Pop. 30,000.

Zabrze, a mining centre of Upper Silesia, Germany, the centre of a coking-coal region in the Upper Silesian coal-field. It has ironworks and foundries, rolling-mills, a glass-furnace, and large chemical-works, &c. Pop. 60,000.

Zacate′cas, a state of Mexico, belonging to the great central plateau, and averaging over 7000 feet altitude. It is more or less mountainous, and is specially noted for the mining of silver, which centres round Fresnillo (q.v.) and Sombrerete (pop. 12,000). Zacatecas (pop. 26,000), the state capital, served by the El-Paso–Mexico City railway, is also a silver-mining centre. Lead, zinc, iron, copper, gold, antimony, salt, &c., are also worked. Area, 24,471 sq. miles; pop. 480,690.

Zafra (ancient **Julia Restituta**), a town of Spain, in the province of Badajos; the junction for Huelva on the Merida-Sevilla railway. There are great cattle-markets, and oil and tanning industries. Pop. 10,000.—Another *Zafra* is in Cuenca province.

Zagazig (Ar. *Al-Zaqāziq*), the capital of the Egyptian province of Sharkiyeh, at the junction of the railways from Cairo, Suez, Alexandria, and Damietta, and on the fresh-water canal, 6 miles from Tell-el-Kebir; a cotton centre, and the scene of Lord Wolseley's victory over Arabi Pasha, Sept., 1882. Pop. 41,740.

Zagreb, the Yugoslav form of the Magyar *Zagrab* and Italian *Zagrabia*, the name of a town better known as Agram (q.v.).

Zambe′zi, the most important river in South-Eastern Africa, and the largest flowing into the Indian Ocean, has its source in the Angola highlands, flows out of Angola into Northern Rhodesia, and from the Caprivi Corridor (see *South-West Africa*) separates Northern Rhodesia from Southern Rhodesia. Entering the Tete district of Portuguese East Africa, it forms the central drainage-basin of that region, and reaches the Indian Ocean by several mouths in the Mozambique Channel opposite Madagascar. The delta of the Zambezi (over 2400 sq. miles in area) commences about 90 miles from the coast, a little below the entrance of the Shiré, the chief tributary, which forms the outlet of Lake Nyasa. The Chinde mouth is the only one useful for navigation, and is becoming more and more difficult (see *Portuguese East Africa* and *Nyasaland*). The length of the river is not less than 1600 miles, and it drains an area of 600,000 sq. miles. Navigation is interrupted by rapids and cataracts, among the latter being the Victoria Falls (q.v.). After passing through Rhodesia, in its middle course, the river enters Portuguese territory.

Zambezia, a general term usually applied to those British-Africa possessions traversed by or drained to the Zambezi, and extended sometimes to embrace the riverine central region of Portuguese East Africa. The Trans-Zambezia Railway links Nyasaland with the ocean at Beira, and avoids the necessity of picking a precarious passage up the Zambezi from Chinde. It branches off from the Beira-Mashonaland railway at Dondo, and cuts across country, through grand forests, and over the Zangue by a five-arch bridge to Murassa, on the river, 157 miles from Dondo and 175 miles from Beira. A ferry (2½ miles) runs to Chindio, whence Blantyre may be reached by rail, 351 miles from Beira. The gauge is 3 feet 6 inches. The Zambezi bridged, the problem of entry to and exit from Nyasaland will be completely solved.

Zamo′ra, a frontier province of North-Western Spain, a plateau (over 1000 feet altitude) broken in the north-west by spurs of the Cantabrians, and drained to the Douro (which traverses the province from east to west) by the Esla (with the Tera), the Valderaduey, and the Tormes (forming part of the southern boundary). Grazing on the plateau and cereal-raising in the river valleys are the chief occupations. Towns include Zamora (the capital), Toro (q.v.), and Benavente (pop. 7000). Area, 4097 sq. miles; pop. 266,220.

Zamora, the capital of Zamora province, Spain, on the Douro; the junction for Medina del Campo on the Plasencia-Astorga railway. There is a trade in grain and wine. Pop. 17,000.

Zamora, a west-central state of Venezuela, comprising part of the eastern versant of the Cordillera de Merida, and a large area of the llanos. Stock-raising is the chief occupation. Towns include Barinas (pop. 5500); the capital, Guanare (pop. 11,000), a sugar and coffee centre; Nutrias; and San Fernando de Apure (pop. 10,000), a trading town and river-port at the Portuguesa-Apure confluence, shipping cotton, indigo, cattle, cacao, &c., downstream to Ciudad Bolivar. Area, 20,000 sq. miles; pop. 55,100.

Zamora, a town of Mexico, in the state of Michoacáan. Pop. 15,000.

Zanesville, a city of Ohio, United States, the county seat of Muskingum county, on Licking and Muskingum rivers; served by the Pennsylvania and other railways. It is a pottery-manufacturing centre. Settled in 1800, it became a city in 1850. Pop. 29,600.

Zangwill, Israel, Jewish novelist and playwright, born in London in 1864. His stories, several of which treat of Jewish life, include *Children of the Ghetto*, *Dreamers of the Ghetto*, *The Mantle of Elijah*, and *Jinny the Carrier*. His plays include *The Melting Pot* and *The Forcing House*. He died in 1926.

Zan′te (ancient **Zakynthos**), a department of Greece, one of the Ionian Islands, 25 miles long and about 12 miles broad; area, 277 sq. miles. The greater part of the interior consists of a fertile and productive plain, almost covered with the dwarf grape which produces the so-called currants. Olives, almonds, oranges, and wine are also produced. The staple export is currants. Zante is the capital. Pop. 42,500.

Zante, a seaport of Greece, capital of the insular department of Zante. Carpets, gold and silver ware, silk goods, soap, &c., are made. Pop. 11,110.

Zanzibar′, a sultanate (British Protectorate) of East Africa, comprising the islands of Zanzibar (640 sq. miles) and Pemba (380 sq. miles), with a total population of about 198,000 (115,000 in Zanzibar Island). Zanzibar town is the capital. The two islands are separated by channels, roughly 25 miles wide, from the mainland, the Pemba channel being open and safe, and the

Zanzibar channel treacherous owing to its coralline reefs and islets and the narrow limits of its deep-water passage. The climate is tropical, the extreme range of temperature in Zanzibar being from 60° to 98° F. Pemba is somewhat cooler. January and March are the hottest months. From November to December (or January) is the major season of rain; March to May is the minor rainy season. The mean annual rainfall in Zanzibar is roughly 60 inches, and in Pemba about 80 inches. Dysentery, tuberculosis, venereal diseases, and leprosy are among the commonest complaints; and although there is a tendency towards decline in certain diseases through the application of preventive medicine and European principles of sanitation, it cannot be said that Zanzibar is a ' white man's country '. *Production.*—In Pemba the higher ridges are devoted to cloves and palms, and the valleys, flooded by the torrential streams during the wet seasons, are tilled for rice. Cloves form the chief export of Zanzibar. Coco-nuts rank second among products, and the bulk of the copra is taken by France. As Zanzibar depends on her customs duties for over 55 per cent of her income, the high export duty on cloves is an invaluable asset, and since nearly all the world's cloves come from the Protectorate, competition is negligible. India and Great Britain are the best customers. Fisheries along the coasts are of some importance. *People.*—The population is mainly Swahili, and the Swahili (Bantu-Arabic) tongue is the lingua franca; but Indian traders and others form a large colony, and there are also Sinhalese, Goanese, African negro-people, Malagasies, and Arabs, the latter, of Omanese descent, forming the upper class of plantation-owners.

History.—Zanzibar is mainly Mahommedan. The Swahili are Shafi Sunnites, although they have also many pagan superstitions, and the royal family belong to the Ibadhi sect, an unorthodox school founded in Oman during 744 A.D. and counting the Imâms of Oman among its staunchest adherents. Their religious differences have never apparently given rise to squabbles between the Sultan and the people. Zanzibar formerly comprised the whole coast between Mogdishu (Magadoxo), about lat. 2° N., and Cape Delgado, lat. 10° 42′ S., with the four islands of Zanzibar, Pemba, Lamu, and Mafia. The continental part of the sultanate eventually passed to German and to British East Africa, and in 1890, by the cession of Heligoland to Germany and the abandonment of Madagascar to France, Britain secured her protectorate over the islands of Zanzibar and Pemba, a British Government being constituted in 1891. After 1906, however, the Imperial Government took a great interest in the Protectorate, which is now governed by the Sultan under the advice of a British High Commissioner and a British Resident. The Sultan is President, and the Resident Vice-President of the Protectorate Council.

Zanzibar, the capital of the Protectorate of Zanzibar, on the west coast of Zanzibar Island; served by light Government railway to Bububu (7 miles). It is a great exchange depot, where merchandise coming from the East Africa mainland is forwarded to India, Arabia, Great Britain, France, &c., and has been assisted in maintaining its economic importance by its magnificent harbour, where all the East African vessels call. Loading and discharge are done by lighters, although there are several piers. Owing to the development of the East Africa hinterland, and the consequent rise of new ports and the development of old ones, the importance of Zanzibar tends always towards decline. Pop. (1910 census), 35,262 (20,000 Swahili, 7700 Indians, and 3640 Arabs).

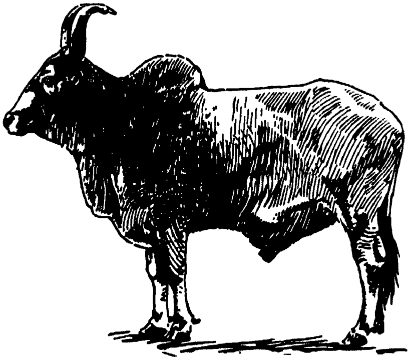
Zara, a seaport of Dalmatia, Italy, on the Adriatic. Its chief industry is the preparation of the liqueur maraschino. Zara was assigned to Italy by the Treaty of Rapallo. Pop. 13,074.

Zea (ancient **Keos**), one of the Cyclades, in the Ægean Sea, the nearest to Attica; area, 67 sq. miles. It is fertile, producing fruit, wine, honey, and valonia. St. Nicolas (*Hagios Nikolaos*) is the port, but Zea (ancient *Iulis*) is the capital and most populous town. Valonia oaks are the chief trees, and valonia, together with barley and almonds, are the chief exports. Sheep, goats, and charcoal are also exported. There are unworked deposits of argentiferous lead, &c. Pop. 4000.

Zealand (Dan. *Sjaelland*), the largest of the Danish islands, separated from Sweden by The Sound and from Funen by the Great Belt; area, 2640 sq. miles. It produces large crops of cereals, and has excellent pasture. It contains the capital of Denmark, Copenhagen. Other towns are: Praestö, Körsör, Kallundborg, Kjöge (all seaports), Elsinore, Holbaek, Roskilde, and Sorö. Pop. 600,000.

Zebra, the *Equus zebra*, an ungulate mammal of Southern Africa, nearly as large as a horse, white, striped with numerous brownish-black bands on the head, trunk, and legs, except on the belly and inside of the thighs. The zebra is extremely difficult to approach, from its watchful habits and great swiftness of foot. Only in a few instances has it been domesticated. See *Dauw*; *Quagga*.

Zebu, a ruminant of the ox tribe, the *Taurus indicus* or *Bos indicus*, called also Brahman bull. This quadruped differs from the common ox in having one, or more rarely two, humps of fat on the shoulders, and in having eighteen caudal vertebræ instead of twenty-one. It is found extensively in India, and also in China, Japan, and Africa.



Zebu

Zechari'ah, the eleventh of the minor prophets, is supposed to have been born in Babylon, and to have been in the first detachment of the exiles who returned to Jerusalem under Zerubbabel and Joshua. He began to prophesy in the second year of Darius Hystaspes, and with his senior contemporary, the prophet Haggai, contributed powerfully by his appeals to the rebuilding of the temple (*Ezra*, vi, 14).

Zedeki'ah, the last king of Judah of the line of David. He took an oath of allegiance to Nebuchadnezzar, which he afterwards broke by entering into an alliance with Egypt. Jerusalem was thereupon besieged by Nebuchadnezzar and taken (588 B.C.). Zedekiah, whose sons were killed in his presence, had his eyes put out, and was carried to Babylon, where probably he died.

Zeebrugge, a town of Belgium, in the province of West Flanders; served by the Knocke-Bruges and Knocke-Ostend railways. It guards the seaward end of the canal to Bruges and has a good harbour; but it is especially remembered as the scene of some extraordinary exploits during the European War. On 8th Oct., 1914, the British 3rd Cavalry Division landed at Zeebrugge, and it was later occupied by the Germans and became a formidable submarine base, since the harbour works were not destroyed on the British retirement. The *Brussels* (Captain Fryatt's ship) was sunk by the Germans as a blockship across the fairway (June, 1916). The British naval action of 22nd–23rd April, 1918, is described under *European War* (section *Last Year of Naval War*).

Zeeland, the most westerly province of Holland, has the greater part of its surface below the sea-level, and protected by dikes. Wheat, flax, and hemp are raised, and much dairy produce is exported. The capital is Middelburg. Area, 707 sq. miles; pop. (1919), 246,880.

Zeeman Effect, in spectroscopy, the resolution of a spectral line into components, when the source of light is placed in a magnetic field. In the simplest case, when the light is viewed along the magnetic lines of force, the spectral line is replaced by two lines, which are circularly polarized in opposite directions; but when the view is at right angles to the field, the resolution is into three lines, all plane polarized.—Cf. F. B. Pidduck, *Treatise on Electricity*.

Zeist, a town of Holland, in the province of Utrecht; served by the Utrecht-Arnhem railway. Porcelain, soap, &c., are made. Pop. 9000.

Zeitz, a town of Prussia, in the province of Saxony. Industries include brewing, cotton-spinning, calico-printing, and the making of soaps, perfumes, pianos, and wooden goods. Pop. 33,090.

Zend-Avesta, the collective name applied to the sacred writings of the Parsees, or Guebers, reverenced as a Bible, prayer-book, and sole rule of faith and practice. The writings comprehended in the *Zend-Avesta* were of vast extent, but comparatively small fragments of them now remain. They were written originally in Zend, then translated into Pahlavi, and afterwards into Parsee, or Pazend. The work, attributed in part to Zoroaster, was arranged probably at the beginning of the third century A.D. It partly consists of *Gâthâs* or songs, some of which may contain the actual words of Zoroaster.—Cf. J. Darmesteter, *Le Zend-Avesta*.

Zengg, a seaport-town of Croatia, Yugoslavia. Mean annual temperature, 58° F. (January, 42°; July, 77°). Pop. 6000.

Zenith, the point of the heavens vertically above an observer's head. The direction of a plumb-line, or the normal to the surface of a liquid at rest, continued upwards, points to the zenith. If the earth were a homogeneous sphere, and did not rotate, the zenith of a place would be exactly in the straight line from the earth's centre through the place, but owing to the ellipticity and rotation, it is slightly nearer to the celestial pole. The opposite point of the celestial sphere to the zenith is termed the *nadir*. The zenith distance of a heavenly body is the arc intercepted between the body and the zenith, being the same as the co-altitude of the body.

Zeno, Byzantine emperor from A.D. 474–491, born in 426. One of the chief events of his reign, which was full of vicissitudes, was the permission given by him to Theodoric to dethrone Odoacer, which led to the establishment of the Ostrogothic kingdom in Italy.

Zeno, of Citium, in Cyprus, founder of the Stoic school of philosophy, born about 340, died 264 B.C. Settling in Athens, he attached himself to various philosophical sects in succession, until he instituted a doctrine of his own. He taught in the Stoa, a porch adorned with the pictures of Polygnotus, whence his followers were called Stoics, and were sometimes designated ‘ disciples of the porch ’. His writings are all lost. See *Stoicism.*

Zeno, of Elea, early Greek philosopher, is supposed to have been born about the beginning of the fifth century B.C. He taught philosophy at Athens, and Pericles is said to have been one of his pupils. He was a favourite disciple of Parmenides, and is introduced as discussing philosophy with his master in Plato's dialogue of that name.

Zeno'bia, Queen of Palmyra, the wife of its king Odenathus, whom she accompanied both in war and in the chase. Gallienus, in return for his services, acknowledged Odenathus as colleague, and when her husband was murdered (A.D. 267) she assumed the sovereignty, conquered Egypt, and called herself Queen of the East. Her ambition provoked the Emperor Aurelian to make war on her, and after a stubborn resistance she fell into his power (A.D. 273), and was made to grace his triumph. She was allowed to pass the remainder of her life as a Roman matron. Zenobia was a woman of great courage, beauty, and linguistic accomplishments, and her studies were directed by Longinus.

Zenta, a town of Slavonia, Yugoslavia, on the Theiss; served by rail to Ó-Becse. It is an agricultural centre. Pop. 30,000.

Zeolites, an important group of mineral silicates of aluminium, with sodium, calcium, or potassium, or all these, and various amounts of combined water. They commonly arise from the alteration of felspars, nepheline, nosean, and similar minerals, under hydrothermal influences rather than under ordinary processes of weathering. *Natrolite*, a hydrous sodium aluminium silicate, *stilbite*, a hydrous calcium sodium aluminium silicate, and *analcite*, with the same constituents as natrolite, but with less silica and water, may be cited as typical species. *Harmotome* includes barium, as celsian and hyalophane do among the felspars.

Zephaniah (zef-a-nī'a), one of the minor prophets, who lived in the reign of Josiah, and who probably uttered his prophecies some time between 630 and 624 B.C.

Zeppelin, Count Ferdinand von, German general, born 1838, died 8th March, 1917. From the Stuttgart Polytechnic and the Military School at Ludwigsburg he passed to the army (1858), and served with the Federal forces in the American Civil War (1863), as well as in the Austrian War (1866) and the war of 1870–1. In 1890 he retired with the rank of general, and devoted himself to aviation. While in America he had become interested in ballooning, and his experiments naturally tended towards lighter-than-air machines. After a successful demonstration (1906) he interested the Kaiser, who made it his business to encourage Zeppelin, and the result of his patronage was the first Zeppelin airship (1909). Zeppelin's primary idea was the construction of an airship to accompany armies and war-vessels for observation purposes, and to carry mails and passengers from point to point. A national Zeppelin fund was raised, and Friedrichshafen, on Lake Constance, became a hive of industry. The rigid type of airship was brought almost to perfection by Zeppelin and his associates, and was used with great effect during the European War, the Allies copying the German construction and ultimately, in post-war ships of the ‘ R ’ type, even surpassing them in many ways.

Zerbst, a town of Anhalt, Germany; served by the Magdeburg-Leipzig railway. It was once famous for beer, and has a brewery, iron-foundry, machine-shops, and manufactures of gold and silver lace. Pop. (1919), 19,210.

Zermatt, a tourist-resort (5320 feet altitude) of Switzerland, canton Valais; served by rail from Visp. It is the jumping-off place for the Matterhorn.

Zeuglodon (zū'glo-don), an extinct genus of whales, in which anterior conical teeth and flattened notched molar teeth were retained in both jaws. They belong to the Eocene and Miocene, and *Z. cetoides* of the Middle Eocene of the United States attained a length of 70 feet.

Zeulenroda, an industrial town of Thuringia, Germany, in Reuss; served by the Werdau-Mehltheuer railway. Pop. 10,000.

Zeus (zūs), in Greek mythology, the supreme divinity; the ruler of the other gods; generally treated as the equivalent of the Roman Jupiter. He was the son of Cronos and Rhea, brother of Poseidon (Neptune) and Hera (Juno), the latter of whom was also his wife. He expelled his father and the dynasty of the Titans, successfully opposed the attacks of the giants and the conspiracies of the other gods, and became chief power in heaven and earth. See *Jupiter.*

Zeuxis, Greek painter, who flourished about 420–400 B.C., and spent his latter days at Ephesus. He belonged to the Asiatic school of painting, the distinguishing characters of which were accurate imitation and the representation of physical beauty.

Zhitomir (Pol. *Zytomierz*), a town of Russia, capital of the district of Volhynia, Ukraine, on the Teterev. Pop. 90,000.

Zibet, or **Zibeth** (zib'et), *Viverra zibetha*, or Indian civet, an animal of the same genus as the African civet-cat. It is found in Eastern

Asia, and in some of the larger islands of the Indian Archipelago. It secretes an odoriferous substance which resembles that of the civet.

Zimbab'we, a group of ruins in Southern Rhodesia, 17 miles south of Victoria. There are two principal structures: a kind of citadel on the crest of a granite hill, and an elliptical enclosure with granite walls on the lower level ground. The latter is divided into chambers, most of which are roofed, and contains two conical solid towers. The ruins are not generally supposed to be very ancient, but their origin is quite unknown. Smaller ruins of similar nature are found elsewhere in Southern Rhodesia and the Transvaal.

Zimnicea, a Roumanian river-port, on the Danube opposite Svishtov; the terminus of a railway from Costesci. It has a shipping trade. Pop. 12,000.

Zimony, the Magyar name for an important commercial town of Slavonia, Yugoslavia, on the Danube at the disemboguing of the Save; served by rail to Budapest and Belgrade. Pop. 18,000.

Zinc, one of the common metals (symbol, Zn; atomic weight, 65·37). Commercially it is known as *spelter*. It has a bluish-white colour, a high metallic lustre, and a crystalline texture. Its specific gravity is about 7; it is relatively hard, and at the ordinary temperatures brittle; between 100° and 150° C. it becomes softer, and can then be rolled into foil or drawn into wire, and then retains its malleability; but at 200° it is again very brittle. It melts at 419° C., and when slowly cooled crystallizes in four- or six-sided prisms. Zinc undergoes little change by the action of air and moisture. When fused in open vessels it absorbs oxygen, and forms the white oxide called *flowers of zinc*. Heated strongly in air, it takes fire and burns with a beautiful white light, forming oxide of zinc. Zinc is found in Germany, the United States, France, Italy, Belgium, Spain, Sweden, &c. It does not occur native, but is obtained from its ores, which are chiefly the sulphide, or *zinc-blende*, and the carbonate, or *calamine*. Important ore bodies containing sulphides of lead and zinc together with silver occur in New South Wales, Burma, Rhodesia, United States, &c. For obtaining the metal, calamine is first calcined and blende roasted; the oxide formed as a result of these operations is mixed with carbon and strongly heated in retorts; the metal is reduced and distils over, being condensed to a liquid in suitable condensers. Recently great advances have been made in the treatment of zinc ores by roasting, solution of the zinc in sulphuric acid, purification of the solution, and electro-deposition of the metal. The oxide of zinc (ZnO) is a fine white powder, insoluble in water, but very soluble in acids, which it neutralizes, being a powerful base of the same class as magnesia. It reacts with both acids and alkalis, generating hydrogen. Several of the salts of zinc are employed in medicine and the arts; the sulphate, $ZnSO_4, 7H_2O$, or white vitriol, is used in calico-printing, and in medicine as an astringent, a caustic, an emetic, and a tonic; the oxide and the carbonate, $ZnCO_3$, are used as pigments, &c. Sheet-zinc is largely employed for lining water-cisterns, baths, &c., for making spouts and pipes, for covering roofs, and other purposes. Plates of this metal are used as generators of electricity in voltaic batteries, &c.; they are also employed in the production of pictures, &c., in the style of woodcuts. Zinc is much employed in the manufacture of brass and other alloys, and in preparing galvanized iron. *Zinc dust* is a fine powder consisting of free zinc together with its oxide, and is obtained during the distillation of zinc.

Zinc-blende. See *Blende.*

Zincography, an art in its essential features similar to lithography, the stone printing-surface of the latter being replaced by that of a plate of polished zinc. See *Anastatic Printing.*

Zinnia, a genus of herbs, order Compositæ, natives of North America. They are old favourites in cottage gardens on account of their gaily-coloured flowers; these approach 'immortelles' in texture, and if dried in hot sand retain their form and colour for a long time.

Zinzibera'ceæ, or **Zingibera'ceæ**, a natural order of plants, of which the genus Zinziber (ginger) is the type. The species are all tropical plants, or nearly so, the greater number inhabiting various parts of the East Indies. They are chiefly valued for the sake of the aromatic and stimulating properties of the rhizome or root, found in ginger, galangal, zedoary, cardamoms, &c.

Zionism, the name given to a Jewish nationalist movement which aims at the establishment of the Jews in Palestine on a national basis. Those who favour this movement differ widely in their reasons for doing so. For some it is mainly an economic and philanthropic movement, for others it is religious and idealistic; not a few support it on account of their social ambition. The movement is consequently supported by arguments often diametrically opposed to each other. Religious Jews who are in favour of the movement believe that by establishing a Jewish home in Palestine, Judaism, or the Jewish religion, will be safeguarded, and Israel will be saved from assimilation. Jewish agnostics and free-thinkers, on the other hand, support Zionism because they are convinced that only in Palestine, in their national home, will the Jews be able to maintain their national unity without requiring the bonds of religion. For these, as indeed for the majority of Zionists, Zionism is first and foremost a national movement, independent of religion, which is the private concern of the individual. If some Zionists, even unbelievers, frequently observe religious ceremonies, their actions are no doubt the result of diplomacy. Jewish *intellectuals* see in the movement an opportunity to develop the national genius of Israel in the historic land; they cherish the dream of giving mankind a new and brilliant civilization. Jewish Socialists, on the other hand, are attracted by the social and economic possibilities latent in Zionism. They foresee the creation of a new state of society, of a social and economic régime based not on capitalism, but on democracy, socialization, and communism. Not only numerous Jews, but also a good many Christians, and particularly Anti-Semites, are in favour of the movement, the latter rejoicing in the hope of getting rid of the Jews in a not dim and distant future. Among the opponents of Zionism are not only the reformed Jews, but also the ultra-orthodox Jews. The reformed Jews deny to Israel the name of nation in a political sense, and consider the Jews as a religious community. Israel's future lies among and is intimately connected with the destinies of the nations in whose midst Jews dwell. Zion is only a symbol, and the national ideal of Judaism is to oppose the idea of nationalism. Judaism is progressive and evolutionary, and even in its first national establishment it contained the seeds of universalism which were destined to blossom forth and bear fruit in the ages to come. Ultra-orthodox Jews, on the other hand, look upon the movement of Zionism as forcing the hand of Providence. For them the Restoration is a religious hope, connected with the coming of the Messiah, who would overthrow the hostile powers, restore the temple and its worship, and inaugurate a Messianic reign. These Jews, therefore, will have nothing to do with a Jewish national movement divested of and frequently hostile to the Jewish religion.

History.—Ever since their dispersion, the Jews (q.v.) have entertained the hope of returning to Zion, or Palestine, and several attempts have been made to bring them to the Holy Land. It was, however, during the nineteenth century, when the national movement among the European nations became more intense (especially after 1859), that Zionism received a new stimulus. The nineteenth century witnessed also the revival of Jewish race-consciousness and national feeling, sentiments strengthened by Anti-Semitism and oppression. Moses Hess published his *Rom und Jerusalem* (1862), and Leo Pinsker his *Auto-emancipation* (1882). The result was the movement of the *Chovevei Zion* (or Lovers of Zion), which inaugurated colonization in Palestine for the purpose of ultimately reviving the Jewish people on their historic soil. It was, however, only in 1896 that political Zionism was founded by Theodor Herzl (q.v.), who published his pamphlet *Der Judenstaat* and advocated an autonomous Jewish state, preferably in Palestine. Herzl enlisted the sympathies of many Jews, and a Zionist Congress was convened at Basel, Switzerland, on 29th Aug., 1897. Here the Zionist political programme was adopted, and its purpose was "to establish for the Jewish people a publicly recognized, legally assured home in Palestine". Great Britain always took an interest in Zionism, and in 1903 the British Government made an offer of land in British East Africa, but the offer was declined by the Zionist organization. On 2nd Nov., 1917, Mr. A. J. Balfour informed Lord Rothschild that "the British Government viewed with favour the establishment of a Jewish national home in Palestine", and would use their best endeavours to facilitate the achievement of this object. The words 'national home' have never been clearly defined. The Zionists maintain that 'national home' means the ultimate establishment in Palestine of an autonomous Jewish commonwealth. Mr. Churchill, however, when Colonial Secretary, defined the words 'national home' in the sense of granting to the Jews the right of establishing colonies, educational, cultural, and industrial institutions in Palestine, "as far as the present inhabitants of the country (Arabs) will allow" (see *Jewish Chronicle*, Aug., 1922). In spite of the vagueness of the formula, the Balfour Declaration was hailed with great enthusiasm by Jews all over the world. Zionists now set to work to claim, in the name of the Jewish people, the granting of the mandate over Palestine to Great Britain. Their proposals were submitted to the Peace Conference in Paris on 3rd Feb., 1919, and were accepted at San Remo on 28th April, 1920. See *Palestine*.—Bibliography: N. Sokolow, *History of Zionism*; M. Bernfeld, *Le Sionisme*; T. Herzl, *Zionistische Schriften*; M. Nordau, *Zionistische Schriften*.

Zircon, a hard gem-like mineral crystallizing in the tetragonal system, and composed of zirconium silicate, $ZrSiO_4$. It is isomorphous with cassiterite, rutile, and thorite. It occurs frequently in igneous rocks rich in sodium, and is very common as minute crystals enclosed in the micas and other minerals of granite. The name comes from the Arabic *zargun*; *jargon*, a colourless to smoky zircon of Ceylon, and the red variety *hyacinth*, are known as gems.

Zirconium, the metal contained in zircon and certain other rare minerals; symbol, Zr; atomic weight, 90·6. It is closely related to titanium and silicon.

Zirknitz, or **Czirknicz**, a lake of Italy, in Carniola, 30 miles E.N.E. of Trieste, about 5 miles long and between 2 and 3 miles broad, without surface-outlet.

Ziska, John, leader of the Hussites, born about 1360, died 1424. He joined as a volunteer the Knights of the Teutonic Order, and fought against the Poles, as also with the Hungarians against the Turks. He is also said to have fought on the English side at the battle of Agincourt. Returning to Bohemia, he became the leader of the Hussites; established himself at Mount Tabor, which he fortified, and where a town grew up occupied by his followers, who thence subsequently took the name of Taborites. His forces achieved the most signal successes by defeating a powerful army of Imperialists at Deutschbrod. While engaged in the siege of Przibislaw he was carried off by the plague.

Zither. This instrument, which is very popular in the Tyrol and Bavaria, consists of a resonant box over which are stretched a number of strings, some of gut and the remainder of wire. The number of strings varies, and may be as high as forty-two. Five of these strings, those lying nearest to the performer, are stretched over frets and are tuned in fifths, the two highest both being tuned to A on the treble stave. On these five strings the melody is played, the performer stopping the wires with the fingers of the left hand by means of the frets, which are at distances of a semitone, and plucking them with a ring-plectrum worn on the thumb of the right hand. The fingers of this hand, excepting the little finger, are used to produce three-note harmonies from the remaining strings, which are arranged in a peculiar order as regards pitch, but one well fitted for the easy production of the required chords. The music of the zither has an agreeable plaintive quality of tone, particularly charming when heard in its native environment.

Zittau, an industrial town of Saxony, on the Mandau; served by rail to Reichenberg, Löbau, &c. It stands on the fringe of a lignite-field, and has an important textile industry. Pop. 36,000.

Zlatoust, a town of Russia, government of Ufa, among the Ural Mountains. It has an observatory. Mean annual temperature, 33° F. (January, 2°; July, 62°); rainfall, 18 inches. Pop. 19,000.

Znejmo (Ger. *Znaim*), a town of Southern Moravia, Czecho-Slovakia, on the Thaya; served by rail to Grusbach, and on the Vienna-Swĕtla (Tetschen) railway. Leather, sweets, beer, &c., are made. Pop. 18,000.

Zoan, the *Tanis* of the Greeks and Romans, an ancient Egyptian city, on the right bank of what was the Tanitic bank of the Nile, now only a canal. It was probably the residence of the Pharaoh of the Exodus, and consequently the scene of the " marvellous things " that were done " in the field of Zoan " (*Ps.* lxxviii, 12). The temple was one of the grandest in Egypt. Its ruins, buried under mounds, have been explored, and one of the chief curiosities found in them is the Canopus stone, with a trilingual inscription, like that on the Rosetta stone, hieroglyphic, demotic, and Greek, recording a decree of Egyptian princes assembled at Canopus 254 B.C.

Zoantha'ria, an order of the class Anthozoa, represented by the sea-anemones and by the majority of corals.

Zo'diac, an imaginary belt or zone in the heavens, extending about 9° on each side of the ecliptic. It is divided into twelve equal parts called signs. The designation 'zodiac' was given from the fact that all the twelve constellations occupying the several signs, except Libra, the Balance, had been named after animate beings. Owing to the precession of the equinoxes, the signs have now parted from their original constellations. The zodiac was marked out by the ancients as distinct from the rest of the heavens because the apparent places of the sun, moon, and the planets known to them were always within it. Many of the minor planets, however, pass at times considerably outside of its limits.

Zodiacal Light, in astronomy, a band of faint light seen in the sky, having its widest part on the horizon, and tapering gradually away to an apex. Its medial line or axis lies nearly along the ecliptic. It is often more brilliant than the Milky Way, but cannot, like it, be observed upon a perfectly dark sky. It is most easily seen in tropical regions. Elsewhere it is best seen in the west after sunset in spring, or in the east before sunrise in autumn. It appears to be due to the reflection of the sun's light by myriads of small particles scattered in and near the plane of the ecliptic. Some of this meteoric dust must extend beyond the earth's orbit, for the light has not only been traced to more than 90° from the sun, but in tropical regions even right round the sky. It becomes fainter and fainter with increasing angular distance from the sun, until at the point opposite the sun's position there is formed a somewhat brighter patch, called the 'gegenschein', or counter-glow. The zodiacal light may be regarded as an appendage of the sun, doubtless continuous with the corona, but differing much from it in constitution.

Zoisite, a colourless or brownish mineral silicate of aluminium and calcium with some hydrogen, differing from epidote in containing no iron. The crystals closely resemble those of epidote, but have orthorhombic symmetry. Zoisite is a common product of the subterranean decomposition of calcium felspars.

Zola, Émile, French novelist, born 1840, died 1902. He first became generally known by commencing, in 1871, the series of novels entitled *Les Rougon-Macquart, Histoire Naturelle et Sociale d'une Famille sous le Second Empire.* One of the series, *L'Assommoir,* portraying the evil consequences of drunkenness, was dramatized by Charles Reade as *Drink,* and became popular. Among Zola's other novels are: *Nana, Germinal, L'Œuvre, La Terre, La Bête Humaine, La Débâcle, Dr. Pascal, Lourdes, Rome, Paris,* and *Fécondité.* See *Dreyfus.*—Cf. E. A. Vizetelly, *Zola, Novelist and Reformer.*

Zollverein, (tsol'fĕr-īn), a certain form of Customs Union, especially that in force among the German states between 1819 and 1871. The Zollverein did much to prepare the way for the establishment of the late German Empire. It was extended mainly through the efforts of the Government of Prussia. Its principal object was the establishment of a uniform rate of customs duties throughout the various states joining the Union.

Zomba, the capital of Nyasaland, on the northern slope of Mount Zomba, in the Shiré Highlands. The mean annual temperature (3000 feet altitude) is 68·5° F. (July, 60·6°; November, 74·5°), and the rainfall 54·2 inches (11·3 inches in January). From November to April is the rainiest season. Blantyre, also at the 3000-feet level, has a mean annual temperature of 68° F.

Zombor, the Magyar form of the Serbian *Sombor,* a town of Slavonia, Yugoslavia; served by the Baja-Neusatz (Ujvidek) and Szabadka (Theresiopel)-Dalj railways. Matches are made, and the grain trade is large. Pop. 30,550.

Zone, (1) in geography, one of the five great divisions of the earth, bounded by circles parallel to the equator, and named according to the temperature prevailing in each. They are: (*a*) the *torrid zone,* extending from tropic to tropic, or 23½° north and 23½° south of the equator; (*b*) two *temperate zones,* situated between the tropics and polar circles, or extending from the parallel of 23½° to that of 66½° north and south, and therefore called the north temperate and south temperate zone respectively; and (*c*) two *frigid zones,* situated between the polar circles and the north and south poles (see *Climate*). (2) In natural history, the name is given to any well-defined belt within which certain forms of plant or animal life are confined; as the different belts of vegetation which characterize the various altitudes on the sides of a mountain.

Zoological Garden, a public garden in which a collection of animals is kept. The gardens of the Zoological Society, Regent's Park, London (familiarly termed 'the Zoo'), founded in 1828, are probably the finest of the kind in the world. They belong to the Zoological Society of London, which was founded in 1826, among its promoters being Sir Humphry Davy and Sir Stamford Raffles. Of the other chief zoological gardens, the Jardin des Plantes in Paris is the oldest, having been founded in 1794.

Zoology, the science which deals with the animal kingdom. Among early workers in *systematic* zoology Gesner and Ray deserve mention, but the science in its present form practically began with Linnæus (1758), who introduced the practice of specifying an animal by two Latin or quasi-Latin words, the first denoting the *genus* and the second the *species.* Linnæus divided all animals into six *classes,* Mammalia, Aves, Amphibia, Pisces, Insecta, and Vermes. Each class was subdivided into *orders* and each order into *genera.* The number of classes was increased to sixteen by Lamarck. Cuvier (q.v.) based classification on anatomy. Since Darwin's time the idea of evolution has had a paramount influence on zoological theory. Other distinguished zoologists were Von Baer, Johann Müller, Owen, Milne-Edwards, Von Siebold, Leuckart, Agassiz, Huxley, Haeckel, Fritz Müller, Dohrn, and Ray Lankester. The names of the standard groupings now generally adopted are *phylum, class, order, family, genus,* and *species.* The phyla are divided into classes, the classes into orders, and so on down the list. It is sometimes convenient to make a minuter analysis, a family, e.g., being divided into sub-families, and a species into varieties, races, or breeds. The classification followed in this encyclopedia will be readily understood on reference to the articles on *Vertebrata* and *Invertebrata,* in which each of these great phyla is divided into sub-phyla, and each sub-phylum into classes. Separate articles are given to the chief classes, orders, and genera, under either their technical or their popular names. As an example of nomenclature, the skylark (*Alauda arvensis*) may be described as of species Arvensis, genus Alauda, family Alaudidæ, order Passeriformes, class Aves, sub-phylum Craniata, phylum Vertebrata. Reference may be made to such articles as *Entomology*; *Ichthyology*; *Ornithology*; *Animal*; *Anatomy*; *Biology*; *Cytology*; *Histology*; *Physiology*; *Fossils*; *Palæontology*; *Geography* (*Distribution of Animals*); *Plankton and Nekton*; *Man*; *Evolution*; *Heredity*; *Hybrid*; *Lamarckism*; *Mendelism*; *Natural Selection*; *Sexual Selection.*

Zoophyte (zō'o-fīt; Gr. *zoon,* an animal, and *phyton,* a plant), the name given by Cuvier to any member of his sub-kingdom Radiata. It is now loosely applied to animals of extremely low organization which present many external resemblances to plants, such as the hydroid zoophytes of the class Hydrozoa.

Zoospore (zō'os-pōr), a spore occurring in cryptogamic plants, which, having cilia or long filiform moving processes projecting from its surface, moves spontaneously for a short time after being discharged from the spore-case of the parent plant.

Zoroastrianism, a religion of ancient Persia, called after its prophet or founder Zoroaster (*Zarathustra*, Pers. *Zerdusht*). It is also known as *Mazdaism* from its supreme god, *Magism* from its ancient priests, and *Parsism* from its modern adherents. The facts of Zoroaster's life are completely obscured by legend, and later tradition has surrounded even his birth with marvels. When his religion was fully established, he was almost worshipped as divine, being considered as above the archangels and next to God. His history was already legendary in the time of Aristotle, who placed him 6000 years before Plato; others have supposed him to be contemporary with Moses. Modern researches place his birth about 660 B.C., or perhaps several centuries earlier. The Zoroastrian Bible is the *Avesta*, or *Zend-Avesta*, but only that portion called the *Gâthâs*, or versified preachings, is the work of the prophet. Zoroaster combined in a metaphysical and ethical system elements which he found around him, transmitted in the teaching of the sages of India and Iran. Both his metaphysics and ethics are based on the idea of dualism, and the warfare between the good and evil principles. Zoroaster imagined two principles which exist in all things, and are respectively the causes of all good and evil. These he called the *Vohu Mano*, or good mind, and the *Ahem Mano*, or evil mind. These primal spirits revealed themselves in vision as twins, and though opposed are inseparable, being apparently the necessary opposites of each other. The one creates day and the other night; the former produces life, and the latter extinguishes it. These two minds exist in Ahura Mazda as well as in all created things. Subsequent interpreters of Zoroastrianism developed these two principles into two distinct and powerful beings, Ormuzd and Ahriman, the good and evil spirits, the Better and the Bad in thought, word, and action. Ahura Mazda or Ormuzd created the world and rules it, but Ahriman, his spiritual enemy or devil, invaded the world and created disorder. Thus nature is divided, but man is a free agent; and by choosing right and obeying the law, by thinking good thoughts, speaking good words, and performing good deeds, he will help to bring about the ultimate victory and triumph of the good spirit, Ahura Mazda, and the annihilation of evil. Among the doctrines of Zoroastrianism are a distinction of a natural and spiritual life, a belief in immortality, resurrection of the body, the coming of a Messiah, and a final judgment. There are numerous resemblances with Judaism and Christianity. Zoroastrianism became the State religion under the Sassanids (A.D. 226–640). See *Parsees*.—BIBLIOGRAPHY: A. S. Wadia, *The Message of Zoroaster*; J. H. Moulton, *Early Zoroastrianism*; A. V. W. Jackson, *Zoroaster, the Prophet of Ancient Iran.*

Zo'simus, Greek historian, who flourished in the time of the Emperor Anastasius, during the first half of the fifth century A.D. He was a pagan, and in his history of the then empire he severely criticized the Christian emperors, representing the substitution of Christianity for paganism as largely responsible for the decline of the empire.

Zostera, a genus of marine herbs, order Naiadaceæ. *Z. marina* is the grass-wrack common on our coasts. It is one of the few Flowering Plants with aquatic pollination; the pollen-grains are long threads with the same specific gravity as sea-water, and are thus able to float at any depth, and the stigmas are very large, as in wind-pollinated plants.

Zouaves, originally mercenaries belonging to a Kabyle tribe. The Zouaves in the pay of the Dey of Algiers were, when Algeria became a French possession, incorporated with the French army there, preserving their Arab dress. Ultimately the native element was eliminated, and the Zouaves became merely French soldiers in the picturesque Arab costume.

Zschopau (tsho'pou), an industrial town of Saxony, on the Zschopau; served by the Flöha-Annaberg railway. Pop. 10,000.

Zuffenhausen, a town of Württemberg; a junction on the Friedrichshafen railway for Kalw (Calw: pop. (1919), 5363; on the Pforzheim-Horb railway). It manufactures leather, wire, and iron goods. Pop. 13,000.

Zug, a central and the smallest undivided canton of Switzerland. The surface, mountainous in the south-east and south, where the Rossberg occupies the frontier, slopes more or less gradually north and west, till it becomes comparatively flat. Zug and Egeri are the chief lakes. The climate, rigorous in the mountainous districts, is mild on the lower south slopes. The chief exports are cattle, fruits, cider, and 'kirschwasser'. Zug is the capital. Cham (pop. 4000), centre of the Anglo-Swiss Condensed Milk Company, on the Zug-Lucerne railway, and Baar (pop. 5000) are other places. Area, 92 sq. miles; pop. 31,570 (mainly German-speaking Roman Catholics).

Zug, a town of Switzerland, capital of canton Zug, on the Lake of Zug; served by the Zürich-

Lucerne railway. Tobaccos, cottons, and soap are manufactured. Pop. 8000.

Zug, Lake of, or **Zugersee**, a lake of Switzerland, in the canton of Zug, 9 miles long north to south; area, 14 sq. miles. The fishing, principally pike and carp, is productive.

Zuider (or **Zuyder**) **Zee** (zoi'dėr-zā; 'South Sea'), a gulf of the North Sea, on the coast of Holland; 80 miles long, 40 miles greatest breadth. It was formerly a lake, but was united with the North Sea by inundations in the twelfth and thirteenth centuries. The islands Texel, Vlieland, Terschelling, Ameland, &c., separate it from the North Sea, with which it communicates by various channels, the principal being Hellsdeur (Hell-gate), between the Helder and Texel. It is very shallow, and to avoid the difficulties of its navigation to Amsterdam the North Holland Canal was constructed. Many proposals have been mooted for the reclamation of some of the land covered by the Zuider Zee.

Zulia, a state of Venezuela, comprising mainly a great lake-studded and partly forested plain fringing the shores of Lake Maracaibo, and traversed by anastomosing rivers (Negro, Zulia, Catatumbo, &c.) disemboguing to the lake. Cacao, coco-nut, sugar, coffee, and cotton are raised. Maracaibo (q.v.) is the capital. Area, 24,950 sq. miles; pop. 119,500.

Zu'luland, a South African territory forming the north-eastern region of Natal. The Tugela is the southern boundary; on the north it has Tongaland, on the east the Indian Ocean. The southern portion of the country consists chiefly of undulating plains, covered with grass, and thinly wooded. The coast region is flat, marshy, and very unhealthy, but is largely covered by sugar-plantations, especially along the Umfolosi river-valley. The inland region is healthy and rich in tropical productions. The Zulus are a warlike Kaffir tribe, and for a time were formidable to the colonists of Natal, possessing an organized army of considerable numbers. In 1879, under their king Cetewayo (q.v.), they came into conflict with the British. At first the war was unfortunate for the British (a body of troops having been annihilated at Isandula), but in July, 1879, a general engagement took place at Ulundi, where the power of the Zulus was quite crushed. The subsequent British reorganization of Zululand did not work successfully, and in 1882 Cetewayo was restored, a strip of country adjacent to Natal being constituted a 'reserve'. Into this reserve Cetewayo fled in 1883, after being defeated by a hostile Zulu chief, Usibepu, and there he died in 1884. However, Cetewayo's son Dinizulu, assisted by Transvaal Boers, vanquished Usibepu, and drove him into the reserve. Ultimately the Boers took possession of a considerable portion of the country, while the remaining portion of Zululand, with the reserve, was (1887) annexed by Britain and (1897) incorporated with Natal, of which it now forms a 'province'. Maize and other cereals are raised, and cattle-breeding is progressive. The holding of land by Europeans is not permitted, except for missionary, trading, or mining purposes. The minerals are valuable, and include gold and coal. Eshowe is one of the chief centres, and is reached by a branch of the Durban coast railway from Ginginhlovu. There are asbestos-mines near Eshowe. The Durban line ends at Somkele, lying in a marshy and malarial peneplain, the centre of the Hlabisa (or Santa Lucia) coal-field. Area, 10,456 sq. miles; pop. about 202,000. See *Tongaland.*

Zürich, a canton of Switzerland, one of the northern cantons, extending from the Lake of Zürich to the Rhine, to which its waters are carried by the Thur, Töss, Glatt, and Limmat. It is highly cultivated. There are extensive manufactures of silk and cotton goods. Area, 665 sq. miles; pop. 538,600 (mainly German-speaking Protestants).

Zürich (ancient **Turicum**), a city of Switzerland, capital of canton Zürich, at the northern end of the Lake of Zürich, on the Limmat, and having on the west the Sihl, which joins it immediately below; a railway centre with steamer services on the lake. The chief industry is that of silk, but cotton-spinning and the manufacture of locomotives and machinery are important. Pop. (1920), 206,120.

Zürich, Lake of, or **Zurichsee**, a lake of Switzerland, lying chiefly in the canton of Zürich, but partly in Schwyz. Its greatest length is about 27 miles; area, 33 sq. miles. The chief feeder is the Linth Canal, communicating with the Wallenstatter-see. It discharges itself at the town of Zürich by the Limmat.

Zutphen, a town of Holland, in the province of Gelderland. It has an active trade, especially in timber and grain, and is notable as being the place where Sir Philip Sidney was mortally wounded in 1586. Pop. 20,673.

Zvornik, a town of Bosnia, Yugoslavia, on the Drina. Pop. 5000.

Zweibrücken (Lat. *Bipontium*; Fr. *Deux-Ponts*, two-bridges), a town of Bavaria, on the Schwarzbach; served by rail to Sarreguemines, Landau, Homburg, and St. Ingbert. Manufactures include velvet, plush, and cotton fabrics. The edition of the classics known by the name of 'Bipont' was published there. Pop. 15,250.

Zweisimmen, a town of Switzerland, in canton Bern and in the Upper Simmental; the junction for Lenk (8 miles) on the Montreux-Spiez railway. It is noted for cattle, and is a tourist centre specializing in winter sports. Pop. 5000.

Zwickau (tsvik′ou), an industrial town of Saxony, the centre of the Erzgebirge coal-mining zone; served by rail to Ölsnitz, Chemnitz, Werdau, and Reichenbach. Manufactures include linen and cotton goods, dyes, and chemical products. Pop. (1919), 69,595.

Zwickau (Czech. Cvikov), a town of Bohemia, Czecho-Slovakia; served by the Röhrsdorf-Zwickau railway. Dyeing, bleaching, and brewing are among the industries. Pop. 9000.

Zwingli, or (as it is often latinized) **Zuinglius**, Ulrich, the Swiss reformer, born 1st Jan., 1484, in the canton of St. Gall, died 11th Oct., 1531. Intended for the Church, he studied at various places, during a second residence at Basel becoming the pupil and friend of Thomas Wyttenbach, a reformer before the Reformation, and from him learned the evangelical doctrines which he afterwards promulgated with signal success. His first overt revolt against the Roman Catholic system was when he was a priest at Einsiedeln (1516), which a supposed miracle-working image of the Virgin had made a favourite resort of pilgrims. He denounced the superstition of pilgrimages so effectively that his sermons were talked of in Rome, and it is said futile offers of promotion were made to bribe him into silence. In 1518 he was appointed preacher in the cathedral of Zürich, where he denounced and baffled a vendor of indulgences. Then followed other denunciations of Roman Catholic practices and doctrines, until Zürich, the authorities of which supported Zwingli, and the people of which adhered to him, became thoroughly Protestant, and adopted a reformed theology, worship, and discipline. Zwingli went further than Luther, whose doctrine of consubstantiation led to what proved on the whole a resultless conference on the subject between him and Luther and Melanchthon at Marburg in 1528. In 1531 the Forest Cantons, which adhered to the Roman Catholic faith, made war upon Zürich, whose troops Zwingli accompanied as chaplain. While in the thick of an engagement at Kappel, near Zürich, he was mortally wounded.—Cf. Samuel Simpson, *Life of Ulrich Zwingli, the Swiss Patriot and Reformer.*

Zwittau (Czech. *Svitava*), a town of Moravia, Czecho-Slovakia; the junction for Skutsch on the Vienna-Prague trunk line. Linen, jute, silk, cotton, and beer are made. Pop. 10,000.

Zwolle (zwol′lė), a town of Holland, capital of the province of Overijssel; served by the Zutphen-Leeuwarden, Almelo-Zwolle, and Utrecht-Kampen railways. Oil-, grain-, and saw-milling are important, as is the trade in grain, cattle, and fish. Pop. (1919), 35,043.

Zygomorphic Flowers, those which are divisible into equal halves in a single plane only, as those of sweet-pea, snap-dragon, orchids, &c. Such flowers are adapted for cross-pollination by the larger and more intelligent insects, such as humble-bees. Also termed irregular flowers.

Zygomycetes, that group of the Lower Fungi or Phycomycetes in which sexual reproduction is carried out by the fusion of similar gametes. Representative genera: Mucor; Pilobolus; Empusa. See *Entomophthorineæ.*

Zygoptereæ, a family of extinct (Palæozoic) Ferns. Together with the Botryoptereæ, likewise extinct, it forms the group of Cœnopterideæ, comprising the most primitive of known ferns.

Zygospore, in botany, a spore produced by the fusion of two similar gametes, as in Conjugatæ and Zygomycetes. Opposed to oöspore (q.v.).

Zygote, in botany, the general term for any cell produced by the fusion of gametes; the immediate product of sexual union.

Zymotic Diseases, a name applied to epidemic and endemic contagious diseases. Owing to the development of bacteriology, the name is now little used.

Zyrians, a Finnish tribe which inhabits part of the governments of Perm (q.v.) and Archangel, Russia. They have to a large extent abandoned their native language and speak Russian. They number about 100,000, and live for the most part by means of hunting.

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